AUTOMOTIVE INDUSTRIES

AUTOMOTIVE and AVIATION MANUFACTURING
ENGINEERING • PRODUCTION • MANAGEMENT

DECEMBER 1, 1956

THE NEW AMERICA THAT'S COMING

Analysis of the Impact of Interstate Highway System

Industrial Expansion
Traffic Safety
Roadbuilding Equipment
Effects on Automobile Design
Construction of Superhighways
Buses for the Future
City Freeways
New Repair Facilities

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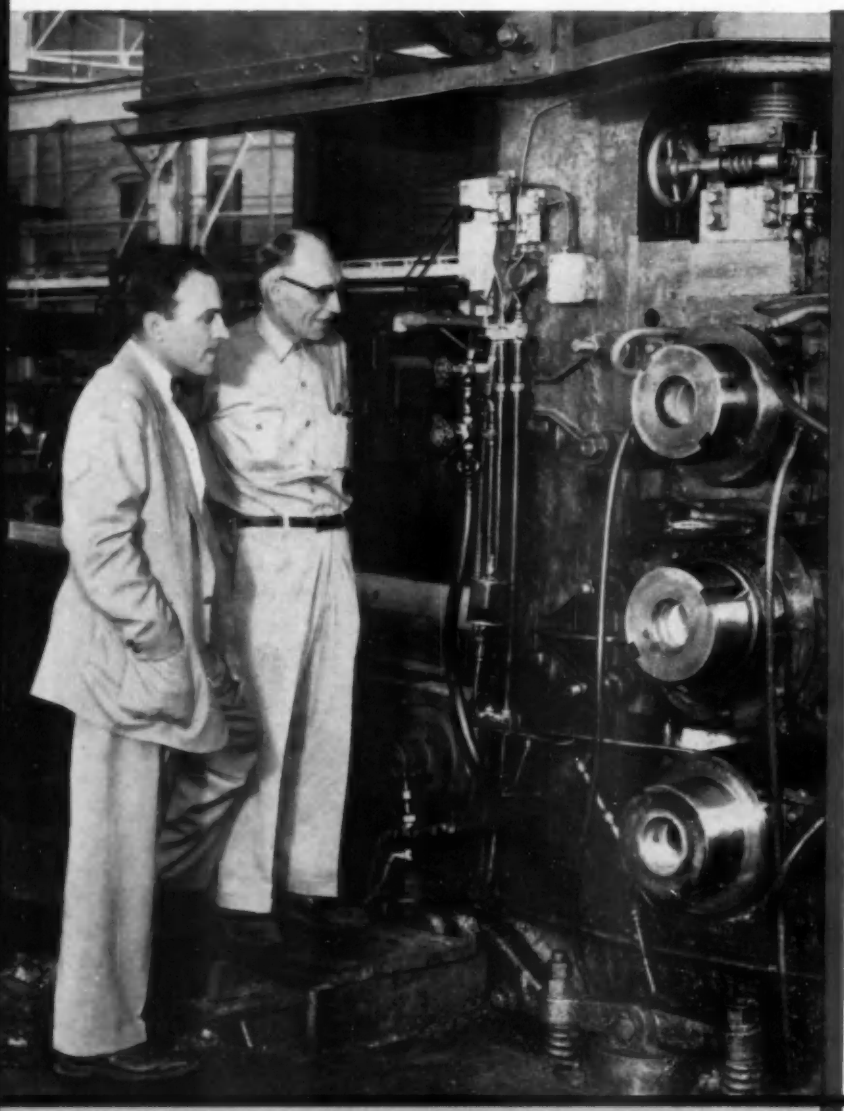
A CHILTON PUBLICATION

Sick slab roll recovers fast with application of STANOGEAR *Compound*



Eugene Ewald (right), Mill Foreman, and Marshall Fox, Standard Oil lubrication specialist, inspect slab roll. STANOGEAR Compound helped solve lubrication problem on roll neck bearings.

Marshall Fox who proposed switch to STANOGEAR with resultant improved operation, is experienced in providing such technical service. Marsh has a Mechanical Engineering degree from Purdue to qualify him for this work. In addition, he has completed Standard's course for sales engineers. This experience and training, customers find, pay off for them.

A slab roll at Matthiessen & Hegeler Zinc Company, La Salle, Illinois, was sick. It suffered from repeated roll neck bearing failures. Bearing temperatures couldn't be controlled. A consultant was summoned—Marshall J. Fox, Standard Oil lubrication specialist. His diagnosis and remedy: Install STANOGEAR Compound and equip the machine with a central pressure system for application. Recommendations were followed. Result: No bearing failures, due to faulty lubrication, since. Maintenance costs reduced. Time lost through breakdowns slashed.

This was a condition made to order for STANOGEAR to remedy. And Matthiessen & Hegeler knew there was a man at hand who could suggest what should be done. It's another demonstration of what this unbeatable combination can do when put to work:

1 **Standard Oil lubrication specialists capable of giving technical help.**

2 **Top quality products *that deliver results required.***

STANOGEAR Compounds contain special additives making them suitable for applications where heavy loads cause welding, seizure or scoring.

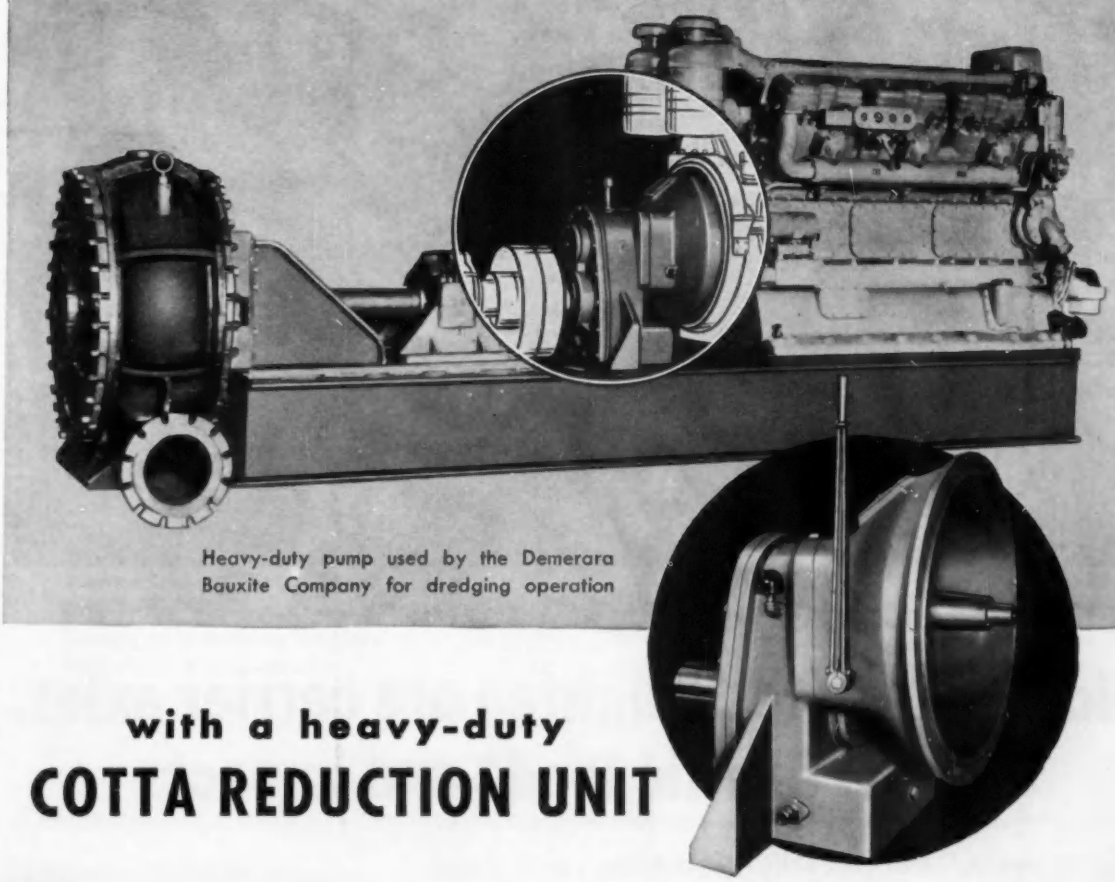
In the Midwest and Rocky Mountain states, a Standard Oil lubrication specialist in your nearby Standard Oil office will gladly give you more information about STANOGEAR. Call him. Or contact Standard Oil Company, 910 So. Michigan Avenue, Chicago 80, Ill.

STANDARD

STANDARD OIL COMPANY

(Indiana)

Another tough speed-reduction problem solved ...the low cost way!



Heavy-duty pump used by the Demerara Bauxite Company for dredging operation

with a heavy-duty COTTA REDUCTION UNIT

This heavy-duty dredge pump has a tough assignment in British Guiana. Operation is continuous . . . machinery is exposed to the atmosphere . . . and it's a long way to the nearest repair or service station.

The dredge builder selected a Cotta Heavy-Duty Reduction Unit to balance the high engine speeds with pump load requirements. Reason — Cotta Reduction Units have time-proved heavy-duty features necessary for continuous, high torque speed reduction applications. You can count on them — thousands are in operation all over the world — when costly repairs and down-time must be eliminated.

For cranes, drillers, locomotives, pumps, shovels, generators and other heavy-duty equipment . . . Cotta Reduction Units offer you top performance, low cost and extended service life. If your speed reduction problem requires these advantages, with input torque ranging from 150 to 2000 foot pounds, come to Cotta!

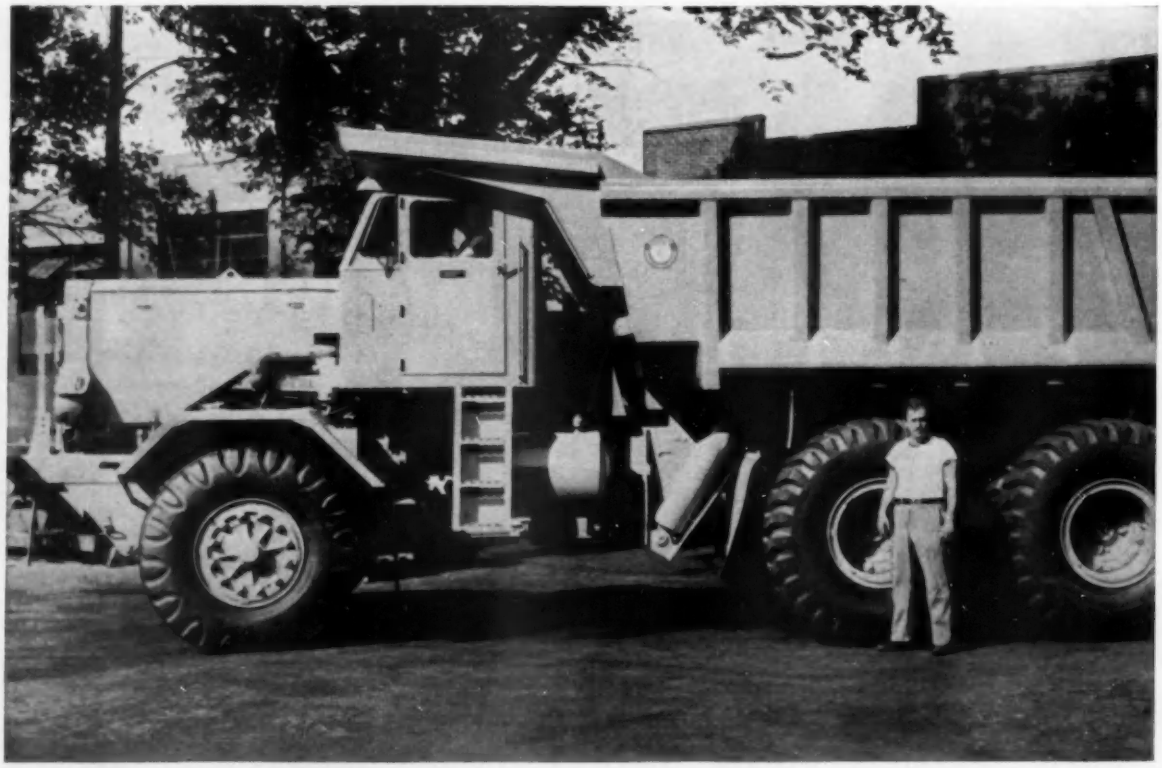
THIS INFORMATION WILL HELP YOU

Sent free on request — diagrams, capacity tables, dimensions, and complete specifications. State your problem — COTTA engineers will help you select the right unit for best performance. Write today.

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS

An Assurance of Dependable Service

COTTA
HEAVY-DUTY REDUCTION UNITS
"Engineered-to-order"



Newest Dart 55-ton...

Nickel alloy steels lighten ore carrier axles, absorb terrific loads and impacts

"In 22 years," Dart metallurgists say, "we've found no stronger, tougher axle steels"

This is a real bear cat . . . 55 tons, 25 cubic yards, 400 horsepower.

It's the latest of a long line of heavy-duty, high-capacity Dart trucks.

Like their first model built 22 years ago, it is designed for maximum load capacity and minimum tare weight. And like their first (many of which are *still* in service) its axle shafts are forged of 4340 nickel-chromium-molybdenum steel. They are heat-treated to a hardness of 400/440 Brinell, equivalent to tensile strengths ranging above 200,000 p.s.i.

The housings are alloy steel castings, of approximately Type 4335 composition, heat-treated to provide a minimum tensile strength of 100,000 and yield strength of 85,000 p.s.i.

Dart has never found another steel to equal the 4300 type for heavy-duty axles . . . and they've tried many. Here's what it gives them:

1. Dependable high strength that allows safe designing for low weight.
2. Toughness to resist bone-shaking impact under heavy loads and low operating temperatures.
3. Good machinability at high hardness.
4. Excellent hardenability.
5. Ready weldability along with high strength in cast housings.

Light, strong, easy-to-fabricate. This is the axle assembly for the Dart ore carrier. Housing contains a triple reduction power transmission; wheels, a double reduction carrier and single reduction planetary. To increase the strength/weight ratio and obtain top-notch casting and machining properties, Dart Truck Company, Kansas City, Mo. makes both shaft and housing of medium carbon nickel-chromium-molybdenum steels.

* * *

Nickel alloy steels are used for dependable trouble-free performance in the most demanding applications. Do you have such a problem in your equipment? Send us the details, we may be able to help you . . . write today.

INCO TRADE MARK **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE — PUBLISHED SEMI-MONTHLY

DECEMBER 1, 1956 — VOL. 115, NO. 11

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● Write for Bulletin 53 giving specifications on these assembly tools and on the complete line of Rotor Tools for all industry. The ROTOR TOOL Company, Cleveland 32, Ohio.

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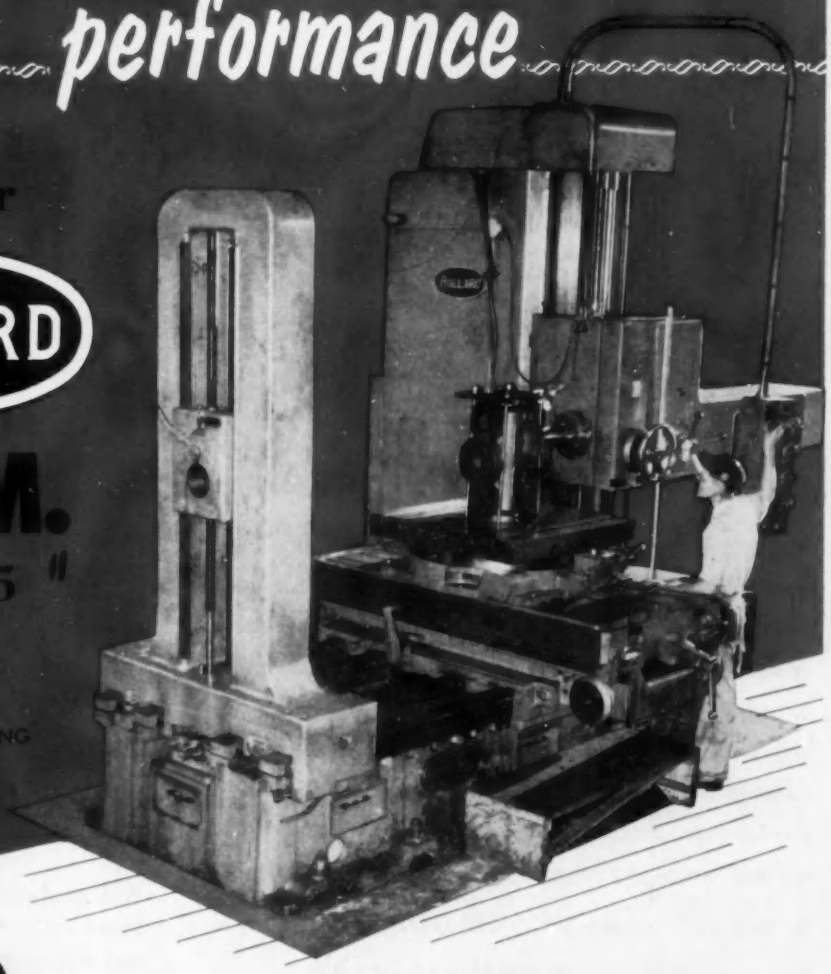
FOR COMPRESSOR

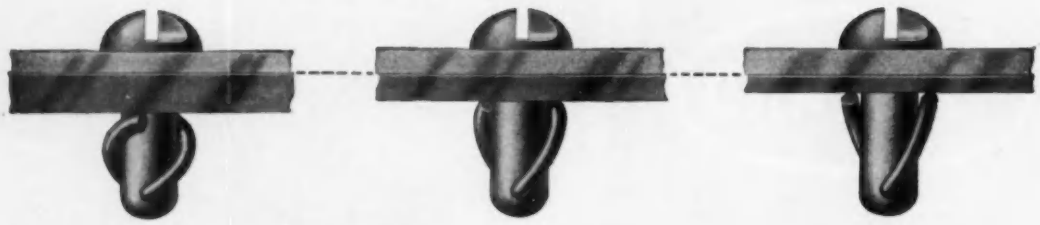


"The acquisition of our Bullard HBM, Model 75 has eliminated a production bottleneck by giving us a reliable machine to handle our output" says Mr. Frank A. Kocevar, Chief Industrial Engineer at The Joy Manufacturing Co., of Michigan City, Indiana, manufacturers of portable and stationary compressors for industry.

This "built-in reliability" of the Bullard HBM, Model 75 can be applied to your boring, milling, drilling and facing problems — check its outstanding features by calling your nearest Bullard Sales Office or Distributor or for a complete catalog, write to —

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

This fastener works through thick and thin!



Spring-Lock—the easy-to-use removable fastener for modern designs—works whether panel thicknesses run over or under specifications! Spring wire deflects automatically to handle greater or lesser thicknesses. Spring-Lock's design flexibility makes it more than a fastener: it can be adapted as a shelf support, door strike, knob or any similar panel-mounted device. Many standard shapes and sizes of Simmons Spring-Locks are available from stock.

SIMMONS FASTENER CORPORATION

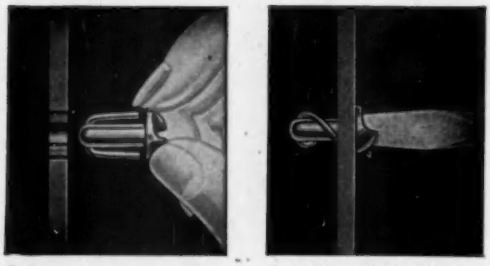
1749 North Broadway, Albany 1, New York

Simmons

QUICK-LOCK
SPRING-LOCK
ROTO-LOCK
LINK-LOCK
DUAL-LOCK

JUST OUT!
NEW 36-PAGE CATALOG WITH APPLICATIONS
SEND FOR IT!

HERE'S HOW SPRING-LOCK WORKS

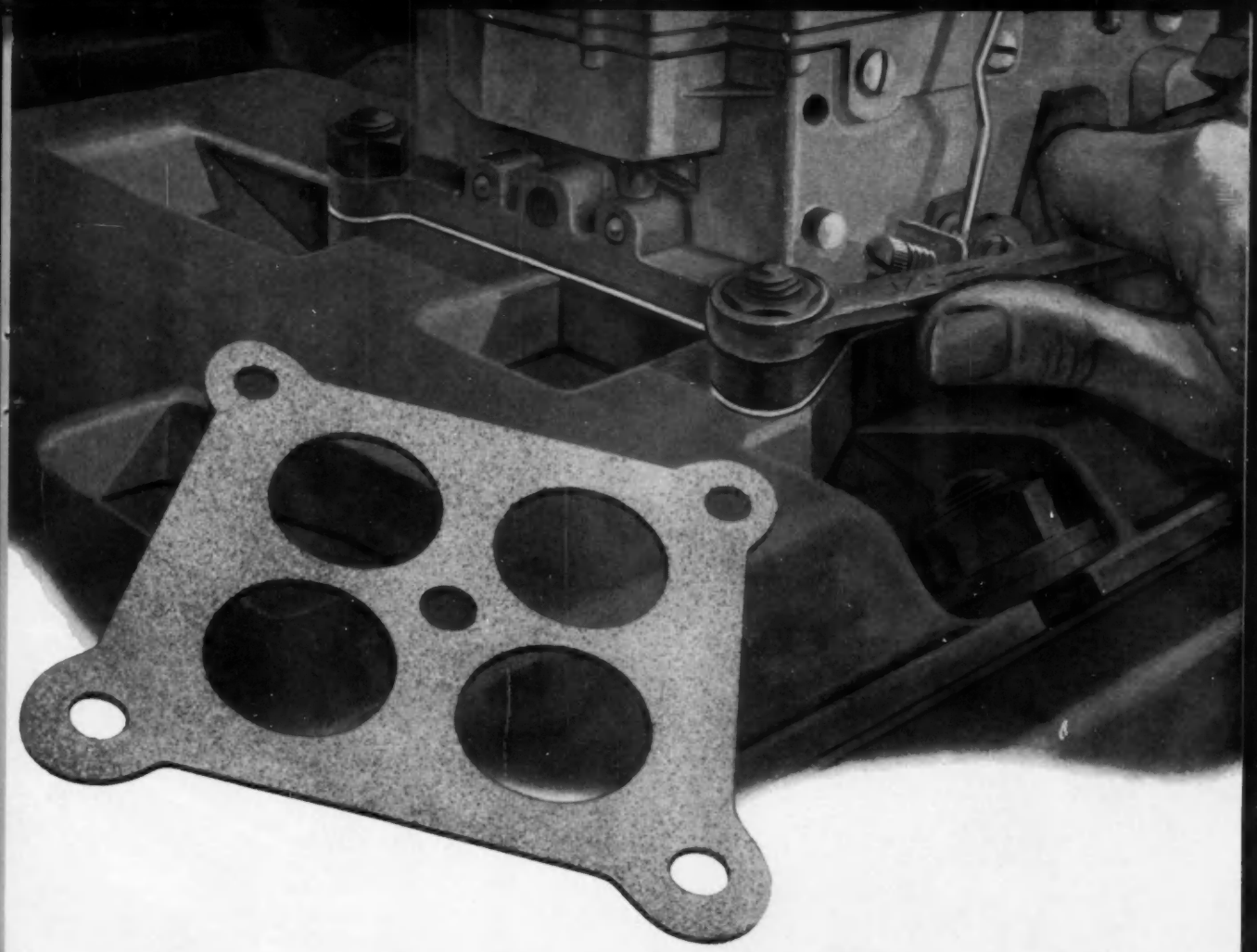


1. *Insert fastener.* **2.** *Half-turn locks it in place.*

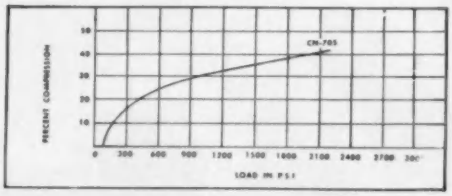
With production costs on the uptrend, you can figure on Spring-Lock as an assembly time and money-saver, because:

- **Installation is BLIND**
- **Installation is EASY: no special tools are needed**
- **Installation is QUICK: a half-turn locks it in place**
- **Installation is SECURE: the *spring* steel *locks* the fastener, resists vibration**

Send for details and samples, or write us about *your* fastening problem.



Accopac® fiber gasket seals tightly at flange pressures as low as 800 psi



LOAD-COMPRESSION CURVE SHOWS high compressibility of Armstrong CN-705 Accopac. This compressibility allows gaskets to seal under light bolt pressures normally available with light flanges.

Armstrong CN-705 Accopac—an improved fiber gasket material—becomes impervious to both liquids and gases at flange pressures as low as 800 psi. This means that CN-705 is ideal for use in lightweight metal assemblies, where low bolting pressures are necessary.

The secret of Accopac's great sealability lies in its manufacture. It's made by a special beater-saturation process that locks cellulose fibers and springy cork particles in a non-extractable nitrile latex binder. This produces a material with both high compressibility and excellent "kickback."

Because its binder is non-extractable, CN-705 will never shrink or dry out—in storage or on the flange. It keeps a tight seal even in alternately wet and dry applications.

For more facts about CN-705 Accopac, write Armstrong Cork Company, 7012 Imperial Ave., Lancaster, Pennsylvania.

Armstrong ACCOPAC

. . . used wherever performance counts

Beauty AND BRAWN

BRAWN to resist the flying stones, road abrasions and weather wear encountered in everyday driving is a particular asset of Stainless Steel designers find highly desirable.

BEAUTY that cannot be duplicated in elegance or endurance, is reason, too, why more Stainless Steel will be used this year than ever before.

only Stainless Steel gives you both

Flashing beauty that compliments any color with which it is used, plus a ruggedness that withstands the punishment of day to day use — only Stainless Steel gives you both these advantages.

Sharon Stainless is actually all colors at one time. For example, a strip of stainless steel, used as a divider between two colors, catches reflects and blends both colors in a rich, eye-pleasing harmony.

And, Sharon Stainless Steel is tough and rugged — an outdoor metal that shrugs off flying stones, road abrasion and weather wear with equal ease.

No other metal has both these desirable traits. That's why discerning automotive designers are adding more Sharon Stainless Steel to each succeeding model.

SHARON *Stainless Steel*

SHARON STEEL CORPORATION • SHARON, PENNSYLVANIA

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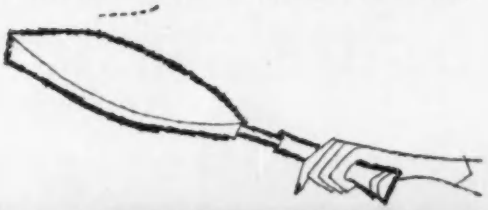
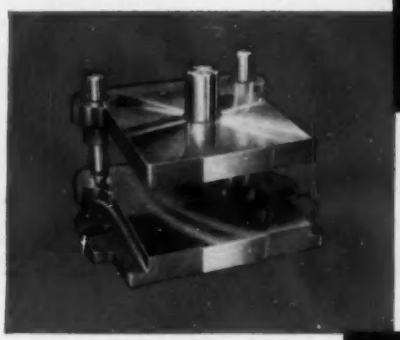
NOW!

All Four Horizontal Surfaces Ground

ON NEW DANLY DIE SETS



To a large extent Danly leadership in die set design can be attributed to its constant search for better methods and means to improve die sets and their operation. Typical of this is the fact that Danly Die Set punch holders and die holders are ground on both sides. By grinding all four horizontal surfaces, Danly assures a true and level alignment when punch and holder are set in the press. Isn't this another important reason why you should specify die sets from Danly?



Complete new "leadership line" catalog

More than 200 pages provide you with complete design information, easier selection of die sets and supplies. Write for your copy today!

DANLY MACHINE SPECIALTIES, INC.

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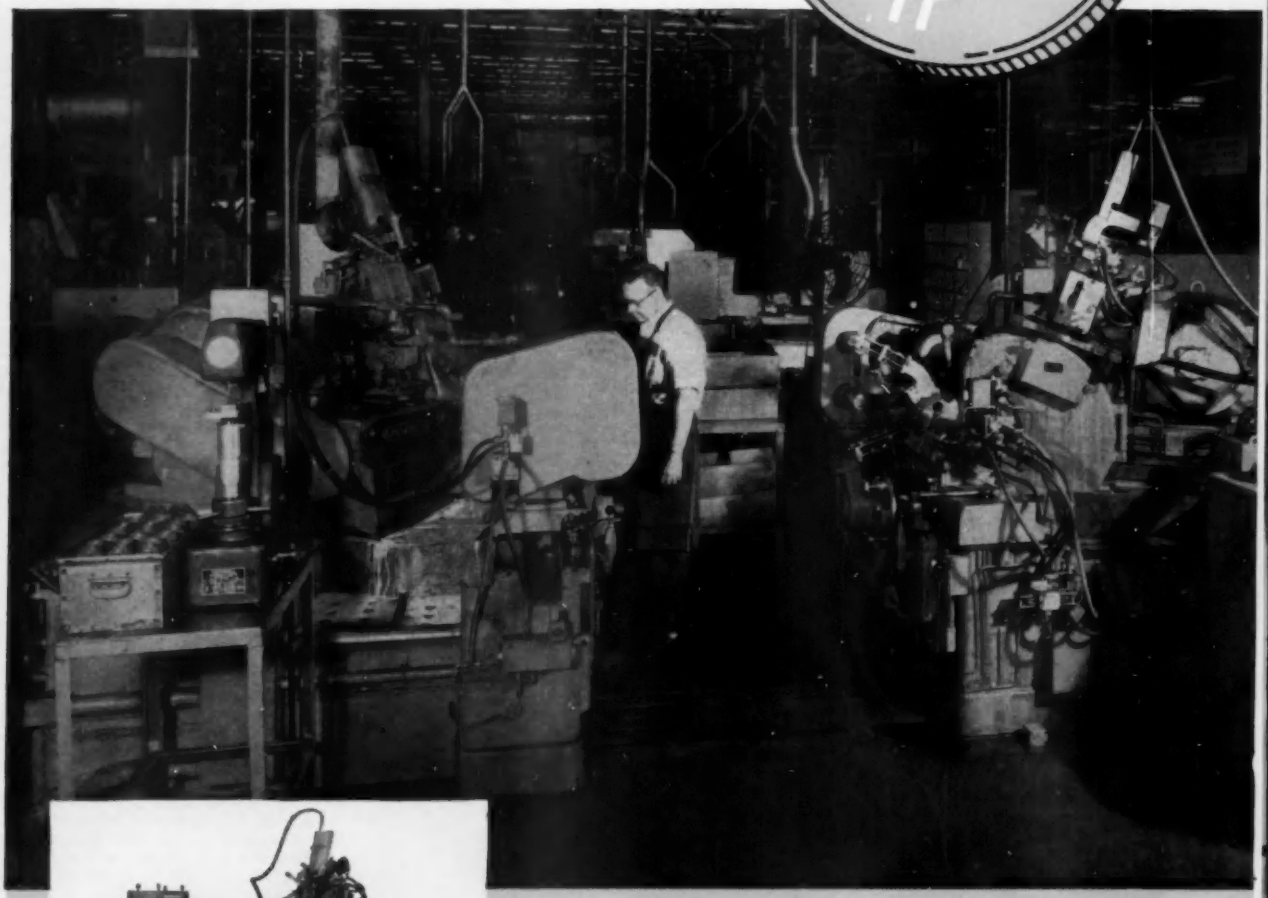
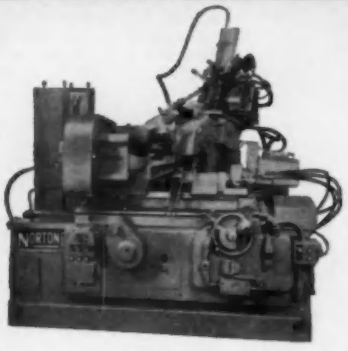
Chicago 50, Illinois

First grinder to do this job — this way!

Versatile Norton Type CV-4 Machines in big transmission plant

enable new cost-cutting operation





TWO NORTON TYPE CV-4 10″ Automatic Angular Wheelslide Grinders that have made possible a new, improved grinding method in the transmission plant of a prominent automotive manufacturer. (See other photo and diagram for details.) These two machines are tended by a single operator, who merely keeps the automatic loading device supplied with parts and removes ground parts from the unloading chute. Designed to grind thrust surfaces and adjacent diameters in one automatic plunge grind, Type CV-4's eliminate the usual separate operation on the shoulder or thrust surface. They are available with hand table or hydraulic power table traverse in 10″ and 14″ sizes, and in work lengths of 18″, 36″, 48″ or 72″.

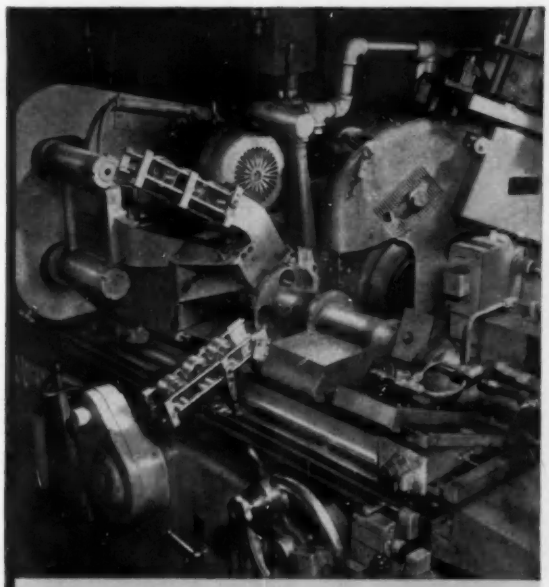
The job described here proves how easily the Norton Type CV-4 Automatic Angular Wheelslide Grinder can be adapted to meet individual needs for more efficient grinding operations.

Doing several fast, precision grinding jobs at once is routine performance for this advanced cylindrical grinder. And it does them better! For example, it leaves a concentric grain pattern in the thrust surface finish, improving the seal surface and appearance. Other "Touch of Gold" advantages for rapid grinding action and top-quality production, with simplified operation and maintenance include:

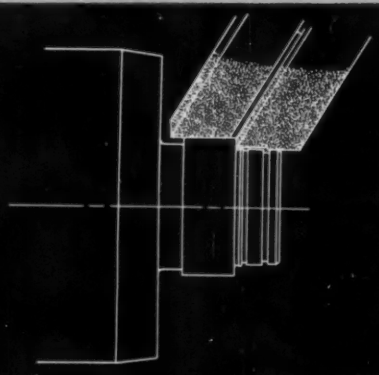
- *Automatic wheel feed with "click-count" index enables settings for wheel slide movement in increments as fine as .00005". Graduated wheel feed hand wheel indicates amount of feed as it rotates. Both length and rate of automatic wheel feed easily adjusted from operation position.*
- *Automatic wheel head mounted truing device (optional) provides push-button control of straight, stepped or formed truing — eliminates need of skill and reduces wheel cost per piece ground.*
- *Ramped outlet from coolant tank speeds clean-out . . . pumps and motors all outside and easy to reach . . . electrical controls all grouped in raised enclosure . . . base ways protected by steel tape guards, requiring no additional floor space . . . hydraulic oil and ways lubricant carried in outside reservoirs with large gauge-glasses.*

Type CV-4's in YOUR Production

can do the work of two or more ordinary cylindrical grinders. Why not get more facts on how replacing obsolete grinding equipment with these modern machines can improve your competitive position and increase your grinding profits? Ask your Norton Representative for Catalog No. 1658-1, or write us direct. And remember, only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



▲ **NEVER DONE BEFORE!** A close-up of one of the Type CV-4 Grinders in the larger photo. Workpieces are being fed into the chuck from a Norton automatic turret-type loading device. An automatic angular plunge grind, followed by automatic traverse off the piece grinds the diameters *and leaves a sharp corner at top of the shoulder* — a new time-saving way to do this job. Stock removal is .025" on diameters and .005" on face. Inset diagram shows surfaces ground and sharp corner left on shoulder. ▼



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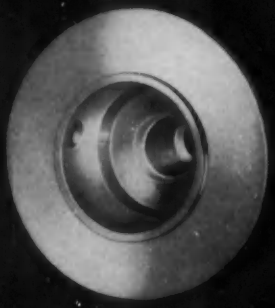
Announcing

the NEW Cross Chucking Transfer-matic

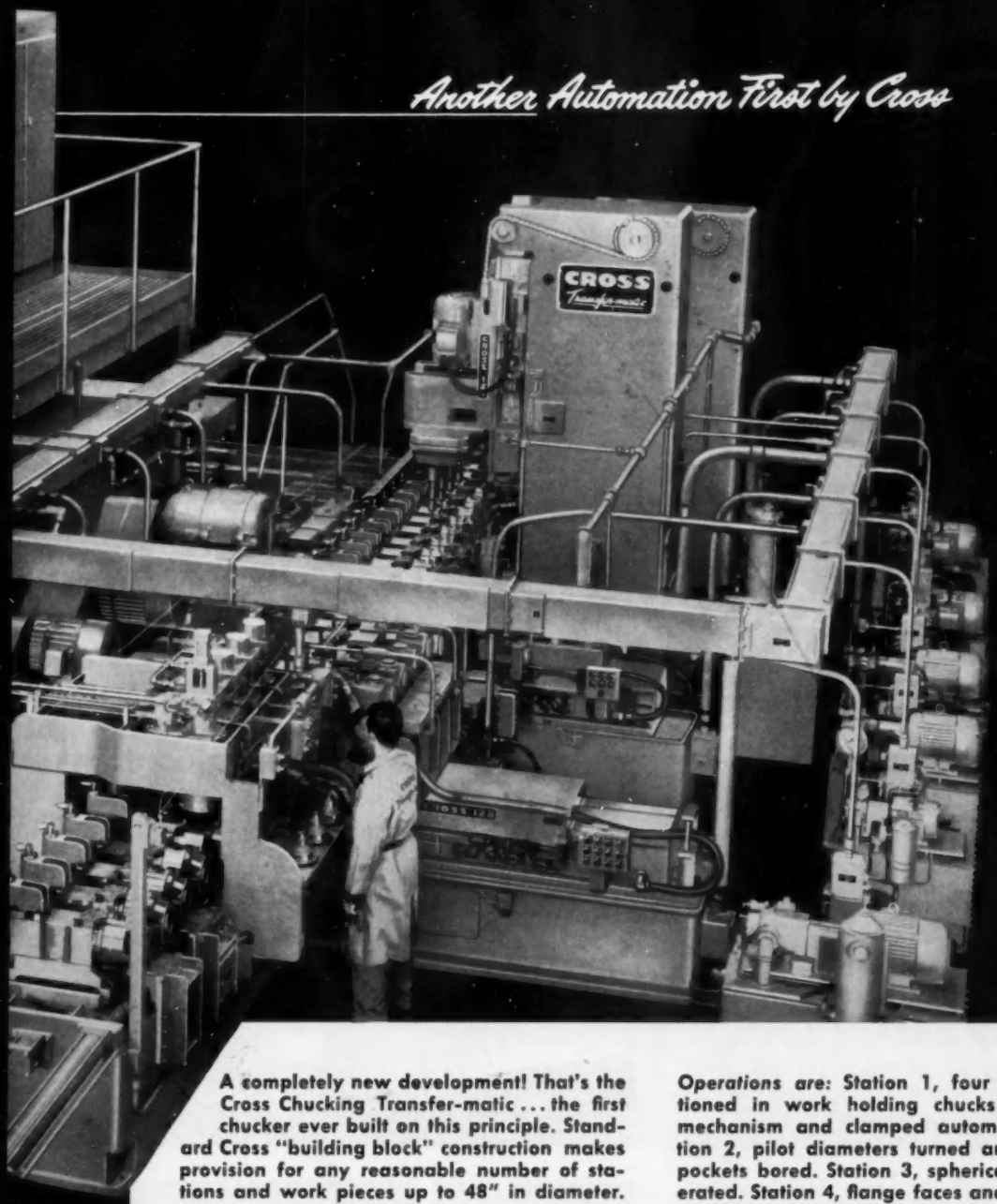
Pat. No. 2,745,167



Station 1

Station 4

Another Automation First by Cross



A completely new development! That's the Cross Chucking Transfer-matic ... the first chucker ever built on this principle. Standard Cross "building block" construction makes provision for any reasonable number of stations and work pieces up to 48" in diameter.

This particular seven station Transfer-Matic, created for differential gear cases, has a rated capacity of 368 pieces per hour at 100% efficiency.

An unusual feature is that the work pieces are chucked and not released until all operations are complete. The chucks are mounted on precision spindles, which in turn are carried on pallets—four to the pallet. There are ten pallets—one at each station and three on the conveyor moving from Station 7 to Station 1.

Operations are: **Station 1, four pieces positioned in work holding chucks by loading mechanism and clamped automatically. Station 2, pilot diameters turned and side gear pockets bored. Station 3, spherical seats generated. Station 4, flange faces and thrust faces for side gears generated. Station 5, pin hole for pinion shaft drilled after spindles are indexed into pre-determined position and locked to prevent rotation. Station 6, pin hole chamfered top and bottom. Station 7, pin hole rough and finish reamed with shuttle head.**

Features include construction to JIC Standards, hardened and ground ways, interchangeability of all parts, pre-set tooling and programmed tool changes with the Cross Machine Control Unit.

Established 1898

THE **CROSS** CO.

First in Automation

DETROIT 7, MICHIGAN

But—here's the low-down on what's handsome **Today:**

AIRFOAM makes interiors roomier, more luxurious

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AIRFOAM gives custom looks and custom rides

Airfoam MADE ONLY BY GOODYEAR

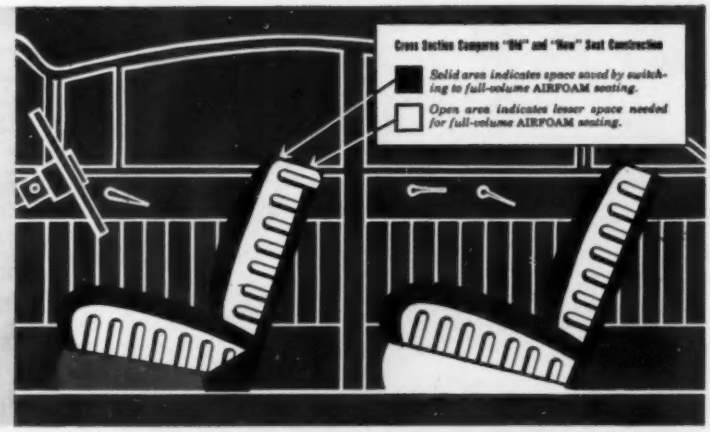
THE WORLD'S FINEST, MOST MODERN CUSHIONING

Airfoam—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

the Holsman took its styling from the Hansom cab—

the bulkier the seating, the han'somer!

And **AIRFOAM** makes new **R-O-O-M** for comfort—and sales:


Cross Section Compares "Old" and "New" Seat Construction
Solid area indicates space saved by switching to full-volume AIRFOAM seating.
Open area indicates lesser space needed for full-volume AIRFOAM seating.

Exciting new seating ideas become practical with AIRFOAM

AIRFOAM can be your greatest sales-aid in years

YEAR

UNTIL THEY MAKE PEOPLE SMALLER, the problems of combining style with *room for comfort* will be Number One Headaches. At least to designers and manufacturers still struggling with outdated upholstering materials and methods.

THE SOLUTION HAS BEEN FOUND by growing numbers in the industry. They recognize AIRFOAM as a completely new and different cushioning *medium*—and, working closely with AIRFOAM Development Engineers, have already achieved wonders in new space engineering.

OLD-TIME BULKY ASSEMBLIES ARE OUT. Smart, compact AIRFOAM Seat-Units are adding style, glamour, comfort—and R-O-O-M!

THE MOST RECENT DEVELOPMENTS warrant a *special* spot in your advance thinking. To get the cold facts before you, simply contact Goodyear, Automotive Products Dept., Akron 16, Ohio.

Welding Output Increased

on Western Electric Coin Box Production

Suppose you needed to spot-weld sheet steel to steel forgings, in hard-to-reach locations. Western Electric's plant at Indianapolis had this problem on telephone coin boxes. Custom-designed electrodes and holders had seemed the way to do the job.

But, since using a standard Mallory heavy-duty offset holder and Mallory bent tips, their welding costs have been reduced and production rate has been increased.

Output increased. The number of parts welded per shift has been increased significantly. Reason: less tip dressing, less setup time loss, cooler operation and minimum respotting.

Longer electrode life. Replacement rate is now less. Reason: better cooling of electrodes . . . all the way to the tip.

Less down time. Re-dressing is now needed only once per shift.

Chances are that you, too, can make substantial savings in resistance welding production, by using Mallory electrodes, holders, seam welding wheels, dies, castings and forgings . . . and by taking advantage of Mallory engineering service in applying these products effectively to your problem. See your local Mallory welding distributor for prompt service, and write to us for our resistance welding catalog.

Expect more . . . Get more from

P. R. MALLORY & CO. Inc.

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Serving Industry with These Products:

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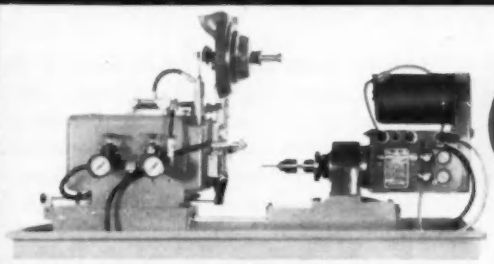
Metallurgical—Contacts • Special Metals • Welding Materials

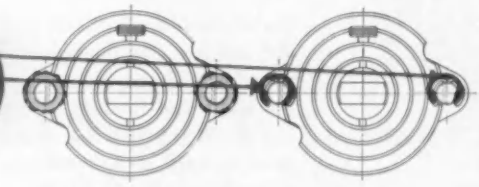
For information on titanium developments, contact Mallory-Sharon Titanium Corp., Niles, Ohio

Waldes Truarc Retaining Rings Eliminate Machining and Parts—Cut Assembly Time on Drill and Tapper



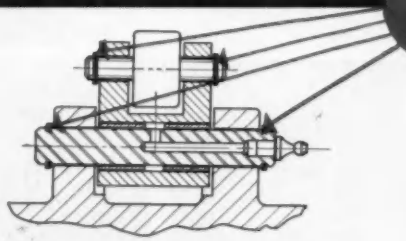
Beco Model 410 Drill and Tapper

The Batchelder Engineering Co., Inc., Springfield, Vermont uses 4 different sizes of 2 different type Waldes Truarc rings in their new BECO Model 410 Automatic Drill and Tapper. Truarc rings speed assembly, reduce machining, improve design.



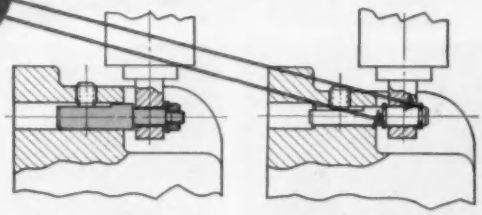
Clamp Cylinder Rod Stop Assembly

Truarc "E" Rings (Series 5133) replace stop nuts in the Clamp Cylinder assembly. They eliminate need for threading 2 rods ...the danger of cross-threading nuts...and costly rejects. Truarc Rings cut assembly time and cost.



Bell Crank Pivot Assembly

Truarc Rings (Series 5100) in Bell Crank Pivot assembly permit grease hole not possible with cotter pin fastener. Use of nuts would have increased machining and assembly costs considerably.



Hopper Cylinder Anchor Pin Assembly

2 Truarc Rings (Series 5100) secure and position end of vertical air cylinder. Rings eliminate extra cost of machining 3-diameter pin, threading and undercutting...plus nut and washer. Assembly is quick and sure.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!

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TRUARC®
RETAINING RINGS
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Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.
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Company .....
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City ..... *Zone* ..... *State* .....

AY 128

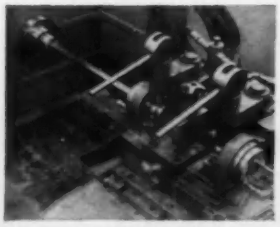
WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

TOMORROW'S SUPER-HIGHWAYS

. . . and Heald precision will help speed

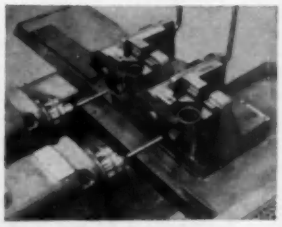
BREAKING the bottleneck of highway congestion, our far-sighted Highway Program will speed motor travel throughout the width and breadth of the entire nation. By 1969 you will be able to drive from coast to coast or between any major points, virtually non-stop.

But where does Heald fit into this picture? Constructionwise, practically everywhere! From start to finish, modern road-building machinery and equipment require a host of precision-parts that can be produced faster, better and more economically on Heald machines — Bore-Matics, Internal Grinders and Rotary Surface Grinders. Entirely apart from the important cost considerations, precision-finishing by Heald can speed production of needed road-building



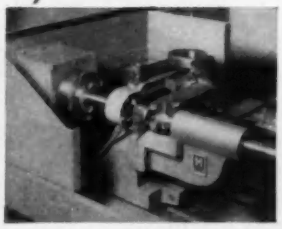
TRANSIT TELESCOPE BODIES precision Borized on two I.D.'s in single, long-bar setup

This Bore-Matic is used to bore two widely-spaced I.D.'s in a long telescope body. The outer end of the long boring bar is supported by a damped tailstock section which engages the bar as the table goes in to bore, preventing deflection and helping eliminate chatter. Machine accommodates eight different parts.



CHAIN SAW PISTONS AND CONN RODS precision Borized on same machine

The Model 221 Bore-Matic shown here does both pistons and conn rods, with easily interchangeable fixtures mounted on aligning rails. In the setup illustrated, pistons are precision bored two-at-a-time. This machine increased production 400% over previous method of doing the same job.

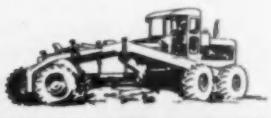


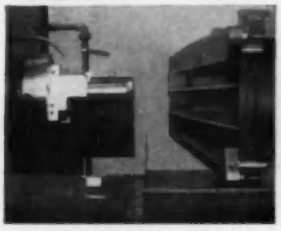
ENGINE CONN RODS FOR PORTABLE COMPRESSORS precision Borized in simple setup at 150 per hour

Heald precision contributes to dependable air power, by Borizing bronze crankpin bushings to a .0003 tolerance for size, and parallel with the bore of the crank end by .004 in 10 inches. Production for this simple setup on a standard Model 121 Bore-Matic is approximately 150 parts per hour at 75% efficiency.

ROCK DRILL VALVE CASES centerless ground on 4 different diameters and 3 faces

This 181 Size-Matic grinds multiple bores in air-drill valve cases, with close tolerances for size, straightness, and concentricity. Four I.D.'s and corresponding bottom faces are ground in sequential runs, changing wheels and table stops only four times to perform all operations on an entire lot of parts.



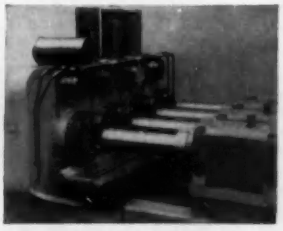


EARTH LOADER DIFFERENTIAL HOUSING bored and faced in fully automatic cycle

This differential housing is precision finished on two in-line bores and front face on a single-end Heald Bore-Matic. Part is hydraulically clamped over locating pins. After boring to a positive stop, cross feed unit automatically performs the facing operation.

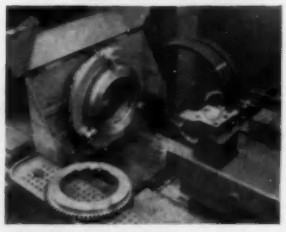
POWER GRADER VALVE BODIES Borized on long, interrupted bore, with damped quill

The bore of scraper control valves must be absolutely straight and free from chatter marks. A Heald Model 221 does the job simply and effectively. The long (9½") bore is finished with a carbide tipped tool held in a damped quill which absorbs self-excited vibration and assures a smooth inner surface.



DIESEL CYLINDER LINERS FOR BOOM-TYPE GRADER bored and chamfered four-at-a-time

This cylinder-liner setup demonstrates the versatility of Bore-Matic design. A four-station hydraulic clamping fixture is mounted on the bridge, and the boring-heads, of special extended design, are mounted on the machine table. Cast iron liners are bored and chamfered, four-at-a-time, to a .001 tolerance.



TRENCHER DIFFERENTIAL CLUTCH GEARS bored, faced and chamfered in single cycle

With this Model 221 Bore-Matic, the work is held in an air-operated rotating fixture, and a hydraulic cross slide carries the boring, chamfering and facing tools. After boring and plunge chamfering, cross slide indexes forward to generate face.

are planned today

construction every step of the way

equipment — and at the same time, add to its useful service life by producing parts with better finish and closer tolerances.

Shown below are just a few typical examples of Heald operations that are improving the performance and dependability of modern highway-type construction equipment from start to finish.

It PAYS to Come to Heald

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THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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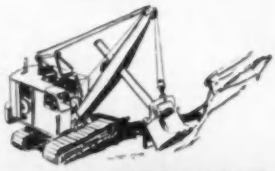
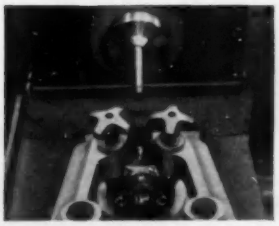


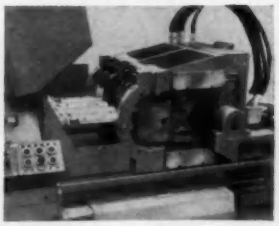
POWER SHOVEL SPROCKETS precision Borized three-at-a-time in trunnion-type fixture

The Model 321 Bore-Matic shown here Borizes cast iron sprockets three-at-a-time with a simple dial bar tooling setup and fast loading, trunnion-type fixture. Three parts are loaded while others are Borizing. Finished parts are automatically ejected and trunnion arm swings new parts into loading position.



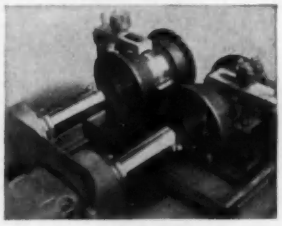
TRUCK STEERING KNUCKLE BUSHINGS Borized simultaneously or sequentially on versatile Bore-Matic

The 221 Bore-Matic shown here Borizes two spaced bushings in truck king pins either simultaneously with a two-tool quill, or in sequence with a single-tool quill boring the front bushing first and jumping at rapid traverse to the rear bushing. Several different sizes are done on the one machine.



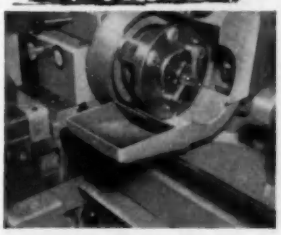
EARTH SCOOP DIESEL ENGINE BLOCKS handled easily, Borized accurately

Here, a large, Model 521 Bore-Matic handles big engine blocks with ease, Borizing four cylinder bores simultaneously. Hydraulically operated trunnion-type fixture, shown in Borizing position, swings up 90° for easy loading and unloading from a conveyor line. Machine handles 3 different sizes of blocks.



CRAWLER TRACK ROLLERS Borized two at a time on Model 321 Bore-Matic

Built to take terrific punishment, crawler track rollers must be precision bored straight, smooth and true. The Model 321 shown here handles these big rollers two-at-a-time. Accurately located and centered in U-shaped blocks, they are hand clamped by two sliding strap clamps on the "U" blocks.

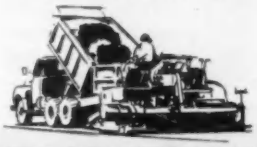


ROLLER CHAIN LINKS FOR ENDLESS LOADER precision ground on Size-Matic Internal

The Model 171 Size-Matic shown here precision grinds the bores of steel roller chain links for endless loaders to a .0005 tolerance for size and .0002 effective pitch parallelism between holes. Link is held in a bore centering fixture with pull-back turn fingers.

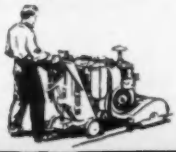
GEAR BLANKS FOR CONCRETE SPREADER bored, faced, turned and chamfered

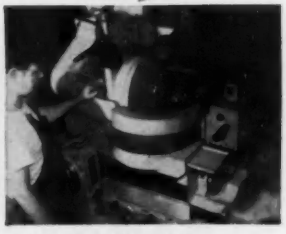
This Model 321 Bore-Matic precision finishes gear blanks on *all* surfaces in three sequential operations. First station drills hole from solid, turns, faces and chamfers. At 2nd station, part is reversed, hole is semi-finish bored and remaining surfaces finished. Hole is finish bored at 3rd station.



ASPHALT SPREADER BEARING RACES precision ground on 30-second centerless cycle

The Heald Model 190 Gage-Matic shoe-type centerless shown here is ideally suited to this type of work. Bearing inner races are chute loaded and all operations are fully automatic. Work is ground to a .0004 tolerance on bore size in a cycle of approximately 30 seconds.

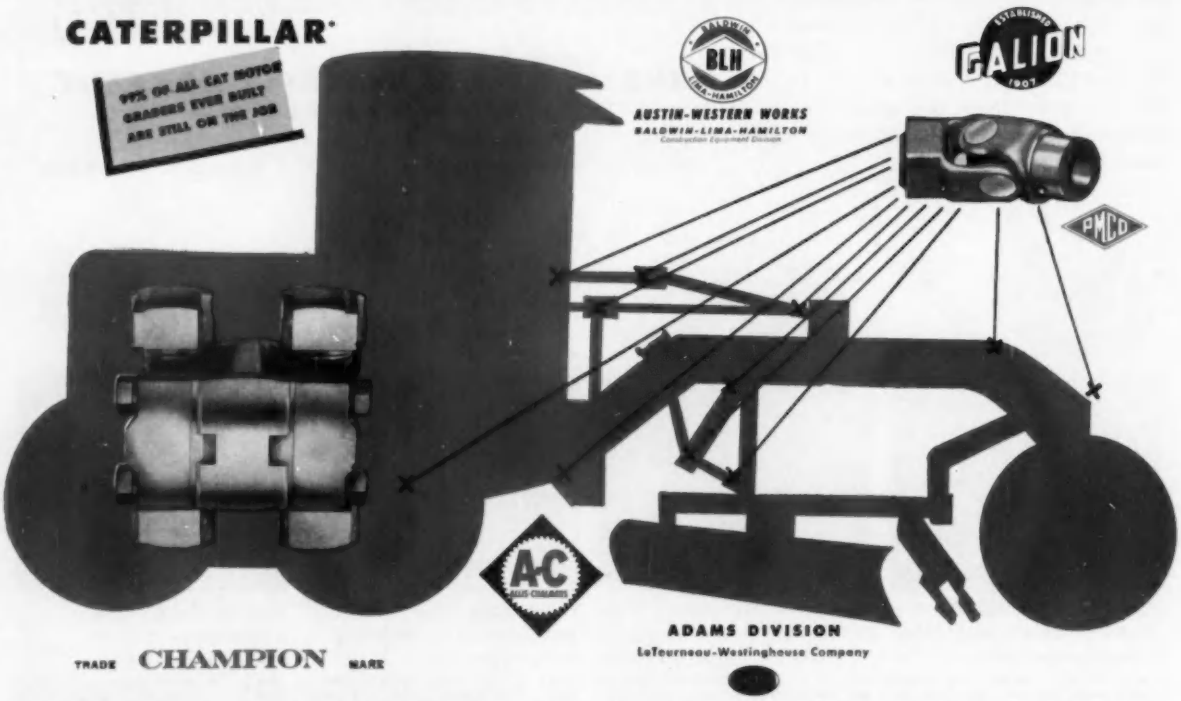




PAVEMENT SAW BLADES precision ground for longer life, on a Heald Model 261 Rotary

Diamond-bonded concrete-saw blades stand up longer on the job because the steel blanks are precision ground on a Heald Model 261 Rotary Surface Grinder. Saw blade blanks are held on a magnetic chuck and both sides ground parallel with a very smooth surface finish.

RELIABLE



Whether for close-coupled main drive lines or for exposed steering and adjustment drives, designers with JOINT problems have learned to rely on MECHANICS. Where joints must run all day at high angles — where there are severe shock loads— where wide angles and long slip are common — and where dirt and/or moisture constantly are present — MECHANICS Roller Bearing UNIVERSAL JOINTS are the accepted solution. *Lubrication is so tightly sealed in that dirt and moisture cannot enter.* If you have a "tough" joint problem, make use of MECHANICS field engineers' wide experience.

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Honeywell's New MEGOPAK thermocouple wire small diameter . . . flexible . . . for use to 1400 F.*

DESIGNED originally for atomic energy projects, this ceramic-insulated packed type thermocouple wire is now available to industry. *MEGOPAK* wire is the latest development in small-diameter thermocouples, with emphasis on durability and high accuracy. It consists of two wires, surrounded by pure magnesium oxide insulation and encased in a metal sheath. This construction insures high accuracy and long life.

MEGOPAK wire is available in *Chromel Alumel*** and iron-constantan calibrations. Both can be supplied in either 1/16" or 1/8" diameter. The 1/8" wire is available with *Inconel* sheathing only, while the 1/16" wire is supplied with *Inconel* or 304 stainless steel.

Lengths up to 25 feet have a minimum resistance of 2.5 megohms at 500 V dc at room temperature, when checked wire to wire or wire to sheath. The wire is flexible enough to be bent around twice its diameter . . . versatile enough to serve in a broad range of applications . . . rugged enough to withstand severe mechanical abuse. Accuracy meets the recommended tolerances of the Instrument Society of America.

MEGOPAK wire is one of the many special pyrometer supplies available with personalized service from your HSM (Honeywell Supplies Man). For complete details, call the HSM at your nearby Honeywell branch . . . as near as your phone. Or write for Specification S001-4.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division,* Wayne and Windrim Avenues, Phila. 44, Penna.—in Canada, Toronto 17, Ontario.

**Trademark Minneapolis-Honeywell Regulator Co.*
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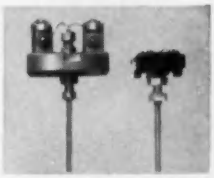
ORDER *MEGOPAK* WIRE OR ASSEMBLIES

MEGOPAK *wire is available in standard lengths from 6 to 25 feet in 6-inch increments.*



Assemblies with terminal blocks are used for replacement units or where a terminal head can't be supported.

Assembly with terminal blocks and head. It's ready to use, with attachment of extension wires.

Assembly with quick-connect plug that need only be inserted in jack for use.

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

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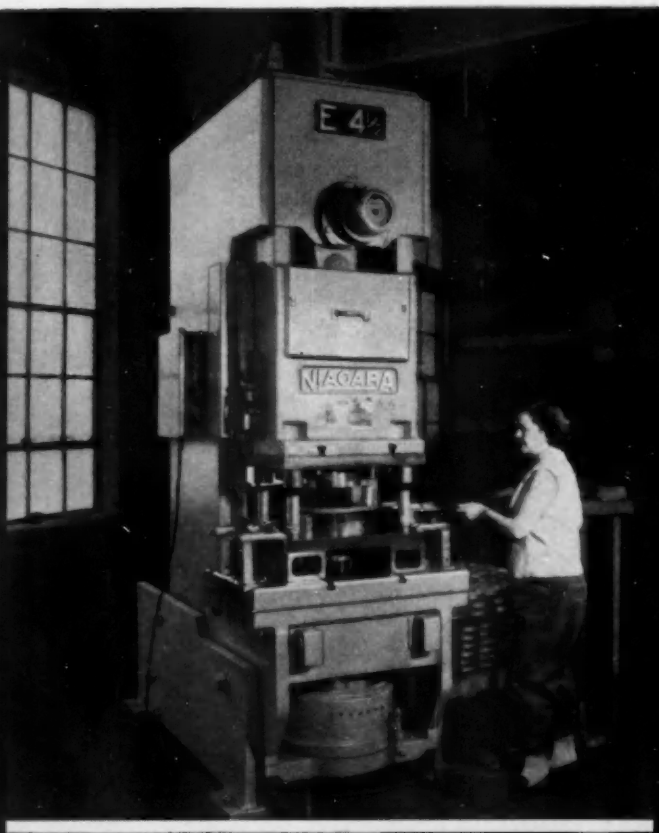
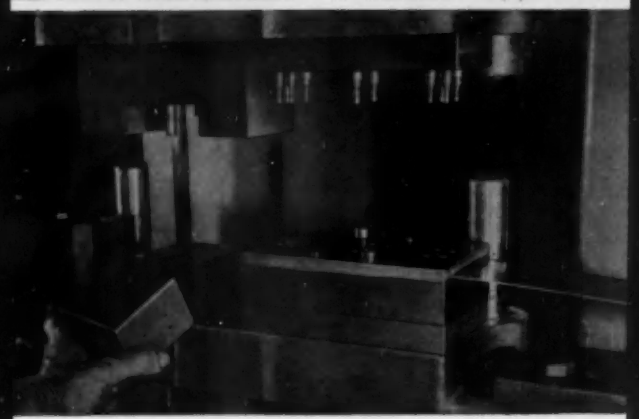
Take it from the early birds...

"IT'S THE GREATEST





Niagara Series E 4½ OBI Press in operation at a well known eastern commercial stamping plant. Work includes stamping small wrenches; trimming canopies for electrical fixtures; piercing, cutting off and forming saddles with a progressive die (shown).

Niagara Series E 4½ OBI Press engaged in blanking and drawing of kitchen cannister lids from half-hard aluminum at midwestern housewares manufacturing plant.

"we can produce from 8,000 to 10,000 pieces in an eight hour day"

"much safer press"

"takes less floor space"

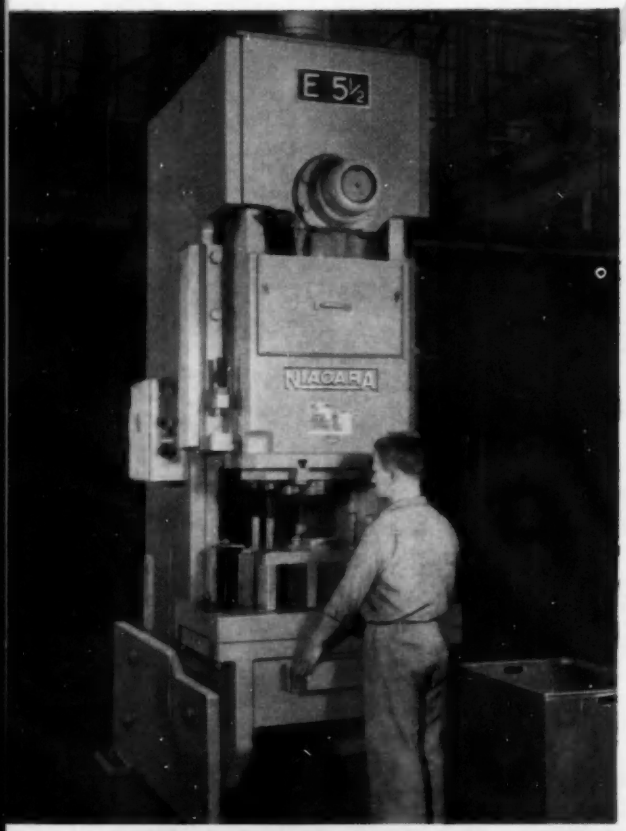
"has a centralized pressure lubricator which we like very much"

O.B.I. EVER BUILT"

"we find that dies without posts work much better on this press"

"all dies give better and longer runs"

"large slide area for large trimming, blanking and progressive dies"



Niagara Series E 5½ OBI Press forming and trimming hemispherical copper parts for one of the "Big Two" electrical manufacturers.

Few developments in metalworking history have drawn the enthusiastic endorsement given Niagara's revolutionary Front-to-Back Crankshaft OBI Press.

Now, as at the 1955 Machine Tool Show where it was unveiled, there is *nothing* even remotely resembling it in the industry ... design-wise and production-wise.

Customers in U.S. and Canada ... the "early birds" who are doing their modernizing with the most modern press of all ... can today tell you about accomplishments with this newest and greatest of OBIs that you would have never dreamed possible. Yes, the press that Niagara conceived to do more than any OBI ever built is doing just that for a fast-growing list of metalworking plants.

There's a huge fund of successful experiences that a Niagara representative can share with you today. Draw on it now and utilize it in your modernization plans. Make a date, at your convenience, for a personal call.

... and if you haven't received new Bulletin 56 with complete design description and specifications (75-200 ton capacities, 4½-7½ inch shaft diameters, standard and automated models) write for your copy at once. You will find it invaluable to your planning.

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America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

NIAGARA

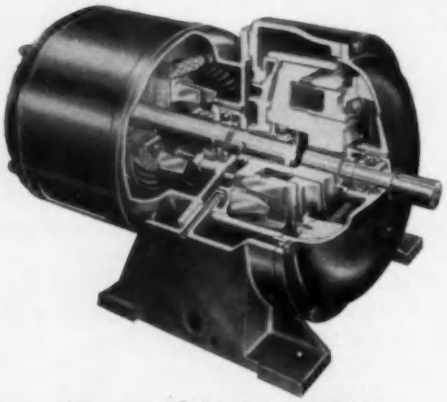
front-to-back crankshaft INCLINABLE PRESSES

No Commutators, No Rings, No Brushes, No Rotating Coils—in the NEW

EATON

DYNAMATIC®

Adjustable Speed Drives



Dynaspede® Stationary Field Coupling, with Integral Motor

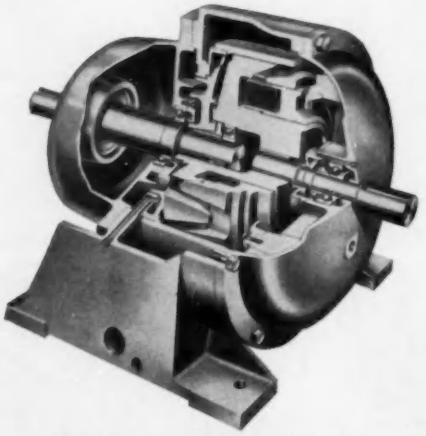
Dynamatic stationary field couplings are the simplest drives so far devised to provide infinitely adjustable speed from an alternating current source. The absence of rotating coils, brushes, slip rings, and commutators in this design holds wear and maintenance to an absolute minimum. Dynamatic electronic or magnetic amplifier controls, in combination with these drives, provide wide latitude in operating functions.

Check these Outstanding Advantages:

Accurate speed control • Wide speed range • Low power losses • Simple construction • Rapid response • Remote control • Quiet, efficient operation • Low maintenance costs

Ajusto-Spede® Drives: Air cooled, stationary field eddy-current couplings mounted integrally with D-flange open drip proof squirrel cage motors are available in capacities from 1 to 75 HP. Units of the same design and capacities are also available without motors.

Dynaspede® Drives: Liquid cooled, stationary field couplings mounted integrally with D-flange squirrel cage motors are available in capacities from 3 to 75 HP. Motor types available are drip proof, splash proof, totally enclosed fan cooled, and explosion proof. The coupling is totally enclosed. Separately mounted couplings are also available in capacities from 3 to 2500 HP and larger.



Stationary Field Coupling for use with Separately Mounted Motor

Send for Detailed Information on these New Stationary Field Couplings and Drives

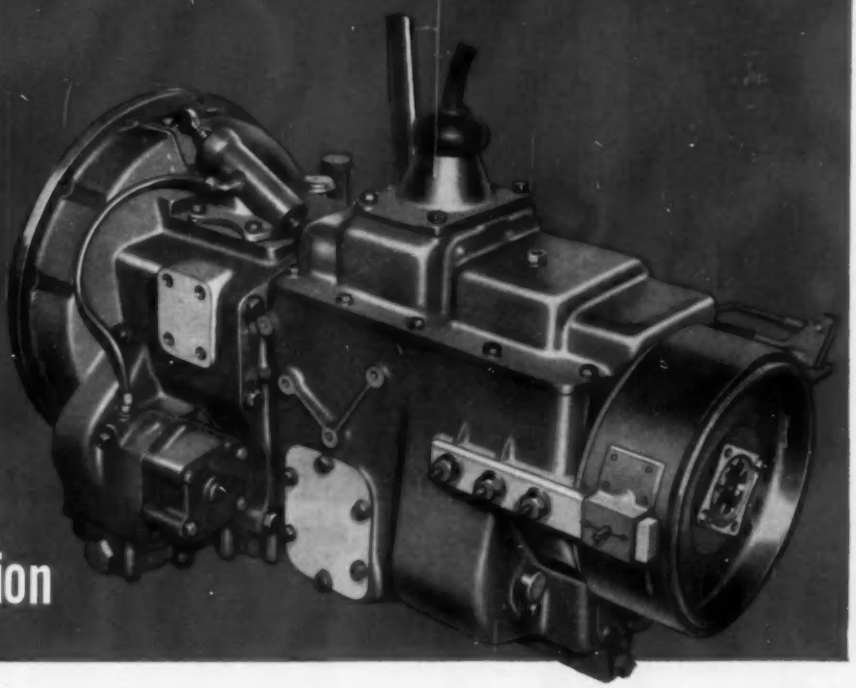
EATON DYNAMATIC DIVISION MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

NEW !

the CLARK TransVerter

COMPACT
UNIT
"PACKAGE"
OF

* Torque Converter
* Hydraulic Clutch
* Transmission



Trucks Operating on delivery schedules

Coaches making frequent stops

Garbage and trash collection

Concrete mixers and similar industrial applications

Materials handling machinery

Many stationary power plants and oil field applications

CLARK EQUIPMENT

Now comes more profitable performance for the operators of stop-and-go vehicles—trucks, both highway and off-the-highway, garbage and trash collectors, concrete mixers, materials handling machines and others: smoother, more economical handling made possible by Clark's new TransVerter.

- **No heavy clutching—reduces driver fatigue. Easy control of hydraulic clutch by shift lever button, floor button, or light pressure clutch pedal**
- **Fine inching control with accelerator**
- **Gear shifting reduced appreciably. Gear changes made quicker**
- **Closely spaced ratios add to ease of shifting resulting in added transmission life**
- **Starts smoothly, no stalling, no lugging**
- **Longer life for entire drive-train—no shock-loading**
- **Less wheel slip—Tires last longer**
- **Clutch adjustment eliminated—Result: savings on costly down time**
- **Excellent accessibility for easy service. Serviceable without special tools by any mechanic familiar with transmissions**
- **Available for OEM or field conversion**

Get the interesting story of these advantages whose economies far offset the moderate additional cost. Send for bulletin.

CLARK EQUIPMENT COMPANY, Transmission Division, Falahee Road, Jackson 2 Michigan
Please send the TransVerter Bulletin

NAME_____

COMPANY_____ POSITION_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

There is NO SUBSTITUTE for a forging: NO SUBSTITUTE for Wyman-Gordon Experience

There is more to the superiority of the forged crankshaft than just strength.

No other method of fabrication can compare with the forging process for dependability. The uniformity and predictability of physical properties with minimum variance from piece to piece or from one location to another in the same piece is assured to the greatest degree by modern forging practice.

Top automotive engineers agree that the use of a forged crankshaft permits the design of a more compact engine which is a decided advantage when thinking in terms of limited space available and overall engine weight reduction.

As compression ratios increase and engine outputs go up the risk factor must be reduced. Again, the uniformity of quality in the backbone of the engine, the crankshaft, is most essential and made possible only by a forging.

There is NO SUBSTITUTE for a forging and in a forging there is NO SUBSTITUTE for WYMAN-GORDON quality and experience.

WYMAN-GORDON COMPANY

Established 1883

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM

WORCESTER 1, MASSACHUSETTS

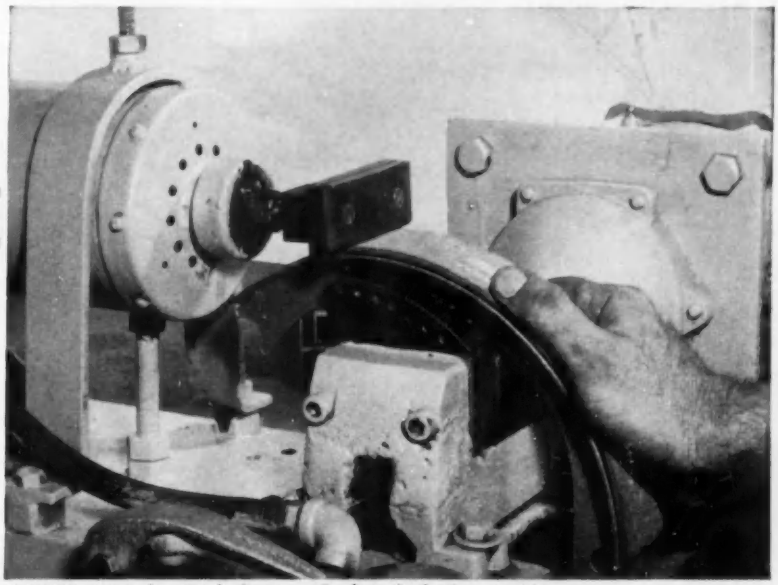
HARVEY, ILLINOIS • DETROIT, MICHIGAN

News about

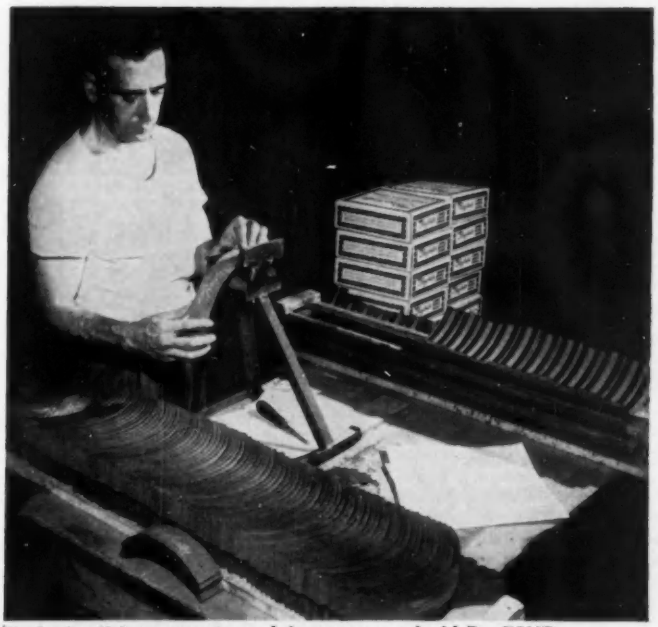
B.F.Goodrich Chemical *raw materials*

Ray-BOND ADHESIVE MADE WITH HYCAR

withstands 2,000-pound shear test



***A 2,000-pound** shear test is given every Raybestos brake shoe assembly to prove sureness of the bond.*



***Raybestos lining segments** are being pre-cemented with Ray-BOND adhesive prior to assembly on brake shoes.*

QUALITY unsurpassed by original equipment is guaranteed on Raybestos-Manhattan reconditioned brake shoes. The lining on every shoe must resist this 2,000-pound pull that tries to separate it from the metal.

This superior bonding is provided by a cement modified with Hycar dry rubber . . . to provide a tough, continuous adhesive film which may be applied uniformly. In service, the adhesive has the strength and elasticity to withstand impact, and excellent heat resistance.

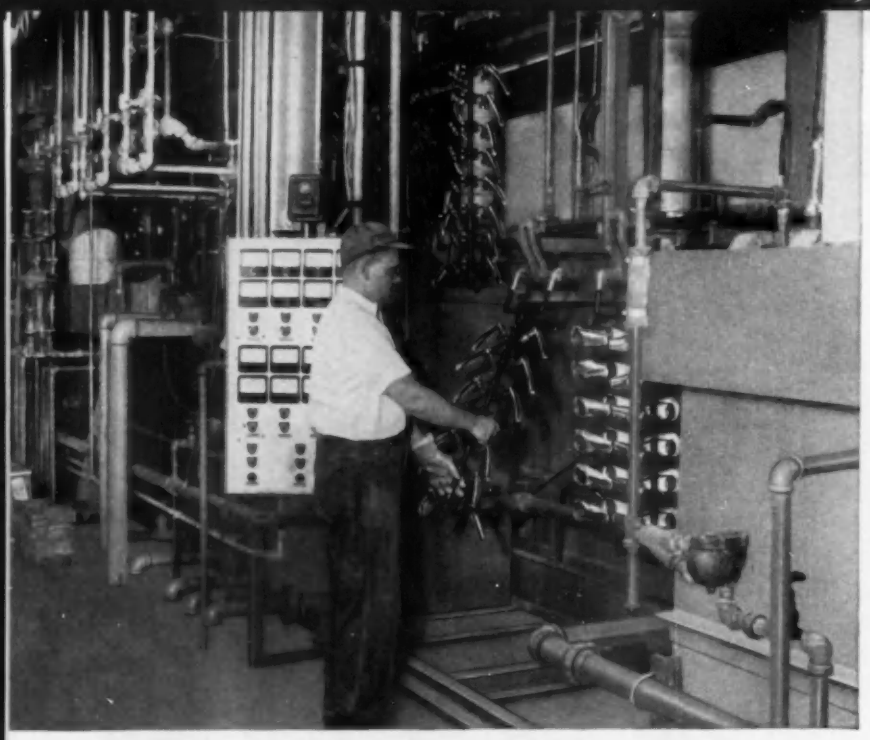
Where you want to improve materials, investigate Hycar. It offers superior oil, water and heat resistance, flexibility with strength, superior aging and abrasion properties. In dry form, compounded Hycar extrudes and molds easily. In latex form, it is an excellent pigment binder and impregnating material.

For complete information write Dept. EA-6, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
A Division of The B.F.Goodrich Company

Hycar
Reg. U.S. Pat. Off.
American Rubber

B.F.Goodrich **GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors**



CUT YOUR PLATING TIME WITH THESE UDYLITE PROCESSES

HI-C Processes Give Faster Nickel Plate on Die Cast or Steel Parts

In plating some 5000 die cast and steel parts per hour, Rival Manufacturing Company of Kansas City, Missouri, use Udylite 514 HI-C and 31 HI-C bright nickel processes in combination with two Udylite Full Automatic Plating Machines.

The HI-C (high chloride) baths give faster bright nickel plate than any processes ever developed and at the same time brighter, more ductile and smoother nickel finishes. They are developments of the Udylite Research Corporation and are the only bright high chloride baths available commercially.

The HI-C processes plate nickel perfectly over copper for die cast parts and provide the important underlay for the final chrome plated finish. They are also used by Rival as the basic coating on steel before the chrome is applied.

As every electroplater knows, where the cycles of copper, nickel and chrome plating are used, nickel plating is the most time consuming. Therefore, Udylite's development of HI-C for speeding up the nickel cycle is of prime importance.

The use of Udylite Full Automatics by Rival has greatly increased efficiency and economy. Only one man is required to inspect the parts and operate each machine. Now there is complete coordination between fabricating, finishing and assembly. HI-C processes and the controlled time cycle of plating have improved the quality of finish and greatly reduced rejects.

A Udylite HI-C nickel process and a Udylite Automatic Plating Machine will save time, money and improve your product. Let us tell you how. Write us today.

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER

CALENDAR

OF COMING SHOWS AND MEETINGS

Society of the Plastics Industry, Film, Sheeting, and Coated Fabrics Div. Conference, Commodore Hotel, New York, N. Y. Dec. 4-5

National Automobile Show, Coliseum, New York, N. Y.....Dec. 8-16

American Institute of Chemical Engineers, annual meeting, Hotel Statler, Boston, Mass. .....Dec. 9-12

Material Handling Institute, annual meeting, Biltmore Hotel, New York, N. Y. .....Dec. 10-11

1957

Second International Automobile, Motorcycle, and Bicycle Show, Mexico City .....Jan. 4-13

Chicago Automobile Show, International Amphitheater, Chicago, Ill. .....Jan. 5-13

SAE Annual Meeting, Sheraton-Cadillac and Statler Hotels, Detroit, Mich. .....Jan. 14-18

Society of Plastics Engineers, annual national technical conference, Sheraton-Jefferson Hotel, St. Louis, Mo. .....Jan. 16-18

Detroit Automobile Show .....Jan. 19-27

National Motor Boat Show, Coliseum, New York, N. Y. ....Jan. 19-27

American Institute of Electrical Engineers, winter meeting, Statler Hotel, New York, N. Y. Jan. 21-25

National Automobile Dealers Equipment Exhibition, Civic Auditorium, San Francisco, Calif. Jan. 26-30

Plant Maintenance & Engineering Show, Public Auditorium, Cleveland, O. .....Jan. 28-31

American Roadbuilders Association, road show and convention, International Amphitheater, Chicago, Ill. .....Jan. 28-Feb. 2

Automotive Accessories Manufacturers of America, exposition, Coliseum, New York, N. Y...Feb. 4-7

Society of the Plastics Industry, 12th annual Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill.....Feb. 5-7

SAE National Passenger Car, Body, and Materials Meeting, Sheraton-Cadillac Hotel, Detroit, Mich. .....Mar. 5-7

Pressed Metal Institute, annual spring technical meeting, Hotel Carter, Cleveland, O. .....March 6-8

Pacific Automotive Show, Civic Auditorium, Seattle, Wash..Mar. 7-10

Atomic Exposition and Nuclear Congress, Convention Hall, Philadelphia, Pa. .....Mar. 11-15

National Industrial Conference Board, fifth conference on Atomic Energy, Philadelphia, Pa. .....March 14-15

Geneva Automobile Show, Switzerland .....March 14-24

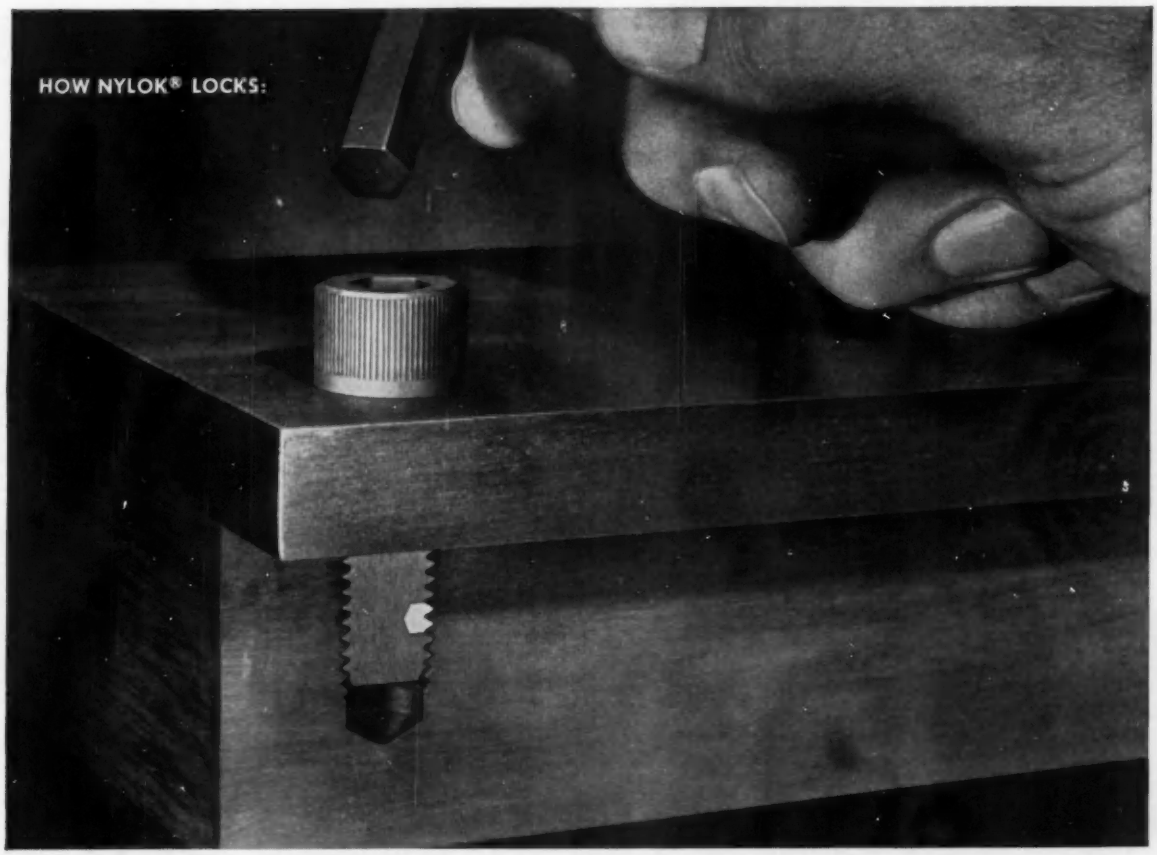
Society of the Plastics Industry, annual national conference and Pacific Coast plastics exposition, Los Angeles, Calif. .March 18-21

SAE National Production Meeting and Forum, Hotel Statler, Buffalo, N. Y. .....March 20-22

American Society of Tool Engineers, silver anniversary technical meeting and convention, Shamrock Hilton Hotel, Houston, Tex. .....March 25-27

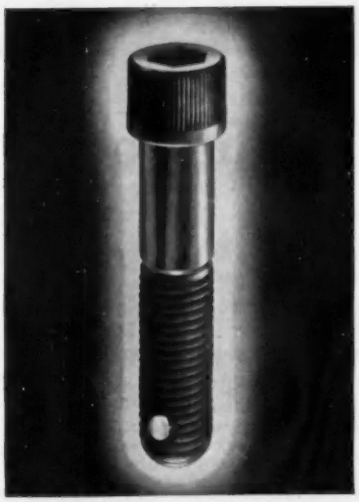
Western Metal Congress and Exposition, Los Angeles, Calif., March 25-29

American Welding Society, national spring meeting and fifth welding and allied industry exposition, Philadelphia, Pa. ....April 8-12



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

NEW—self-locking UNBRAKO socket head cap screws



Self-locking UNBRAKO socket head cap screw.

They won't work loose. And they simplify design and save production time.

UNBRAKO socket head cap screws are now available embodying the Nylok* self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 53, Pa.

**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION

SPS

JENKINTOWN PENNSYLVANIA

Planning for tomorrow • Producing for today!

For a third of a century Bendix Products Division has demonstrated time after time its ability to not only meet current production demands, but to actually anticipate future automotive requirements.

For example, Bendix* Power Braking and Power Steering are today two of the industry's most popular new car features because Bendix started planning them years ago.

Likewise, new products now being developed at Bendix Products Division may well be expected to make automotive headlines on future new car models.

That this Bendix program of constant progress will continue is a certainty because looking ahead plays such a very important part of the job at Bendix.

*REG. U. S. PAT. OFF.

BENDIX PRODUCTS DIVISION **SOUTH BEND** INDIANA

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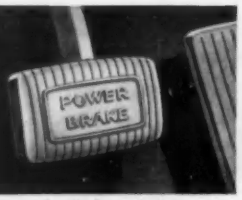
TYPICAL EXAMPLES



Bendix Power Brakes

Bendix Power Steering

Bendix Products Division

Bendix AVIATION CORPORATION

BRAKES • POWER STEERING • POWER BRAKING • CONSTANT VELOCITY UNIVERSAL JOINTS • HYDRAULIC REMOTE CONTROLS

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High Spots of This Issue

★ **National Automobile Show to Launch Some Surprises**

Back in New York City after 16 years is the biggest automotive extravaganza of them all. Some makers are going to unwrap new production models for the public. See Page 35.

★ **Expressway Horizons and Superhighways for Tomorrow**

Relief from stop-and-go crawling is at last in sight for the long-suffering motorist. How the Highway Act of 1956 will open new vistas of travel is told here. Pages 51, 53.

★ **New Hope for Large Cities**

Expressways through and around urban areas promise restored vitality for congested cities. Progressive elimination of slums will be emphasized by planning groups. See Page 61.

★ **Future Highways to Incorporate "Built-in" Safety**

More stress will be laid on engineering approach in building of tomorrow's highways. Free flow of traffic and elimination of hazards to save many lives and dollars. Page 71.

★ **Industrial and Business Expansion Along Highways**

Like chicks following a mother hen, plants, stores and workers' homes follow good transportation routes. Such will be the mobile pattern of the America to come. Page 81.

★ **Construction Equipment Manufacturers Prepare**

Key players in the highway drama are those who make the specialized machines needed to stage it. Analyzed here are the demanding requirements they confront. See Page 89.

★ **Vehicles of the Future and Service Facilities**

More powerful engines will drive the cars, trucks, and buses of tomorrow at higher speeds along new superhighways. Special service needs are under study. Pages 96, 100, 105, 110.

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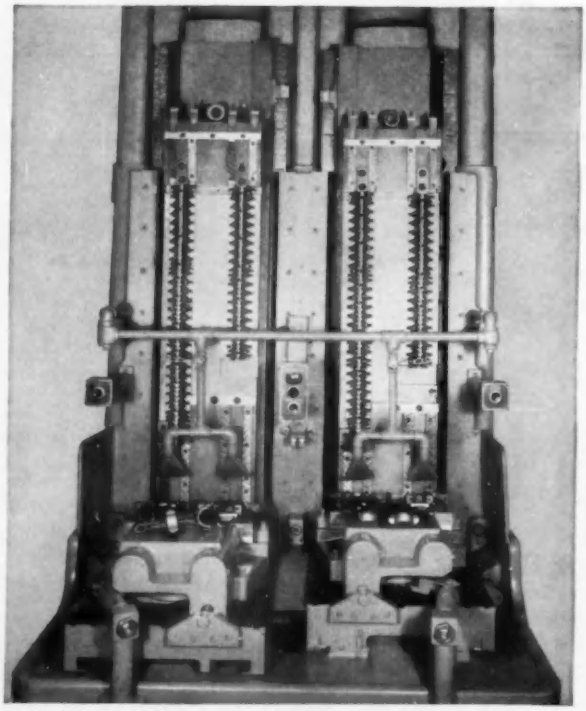
Automotive and Aviation News, Page 33

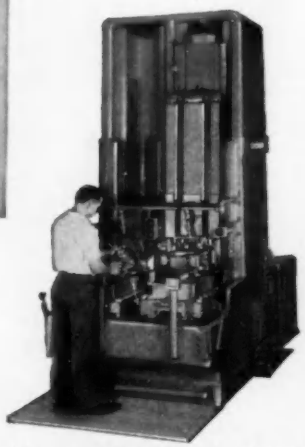


Complete Production Package *by Cincinnati*

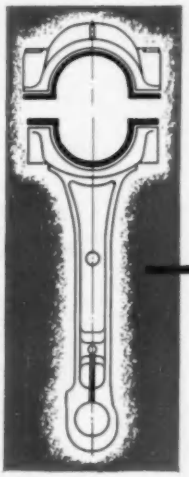
Hydro-Broaches 290 sets of Parts per Hour

Caps and connecting rods for automotive engines are usually required in large volume, and those broached on the equipment illustrated here are no exception. To meet the production requirements of 580 parts per hour (290 sets) Cincinnati Application Engineers tooled up a No. 10-66 Duplex Vertical Hydro-Broach with two labor-aiding mechanically actuated automatic fixtures. Each holds one pair of parts—a cap and a rod. Clamping and unclamping are automatic . . . the operator is concerned only with positioning and removing the work. ¶ Several Hydro-Broach features contribute to the uniformly high production required for work of this type. Because of the alternating cutting cycles for the rams and tables, broaching is practically continuous; ways are hardened, ground and automatically lubricated for long productive life span; pre-set cycle control safeguards the operator. ¶ Our Application Engineers will give you the benefit of their experience in recommending and tooling up new CINCINNATI machines—milling or broaching—for the lowest cost production of your work. And if you're not familiar with the new CINCINNATI Duplex Vertical Hydro-Broach Machines with receding tables, write for literature.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach. Write for Catalog No. M-1848 which contains complete engineering specifications.



Drawing of connecting rod and cap broached on the All-Cincinnati equipment illustrated here:

Part name	Connecting rod and cap
Material	Steel forging
Operation	Broach half bore and parting face
Depth of cut	3/32"
Broaching speed	34 feet per minute
Production	580 parts (290 sets) per hour
Machine	CINCINNATI No. 10-66 Duplex Vertical Hydro-Broach

CINCINNATI

CINCINNATI

MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 115, No. 11 **December 1, 1956**

Mercury Prices Hiked 6.1%; Three New "Wagons" Added

Mercury has posted price increases on its 1957 models (see AI, Nov. 1, p. 62) that range from $100 on the four-door sedan in the Montclair series to $222 on the convertible in the Monterey series. They average 6.1 per cent above comparable 1956 models. One model, the top-priced station wagon, has been increased by about 12 per cent.

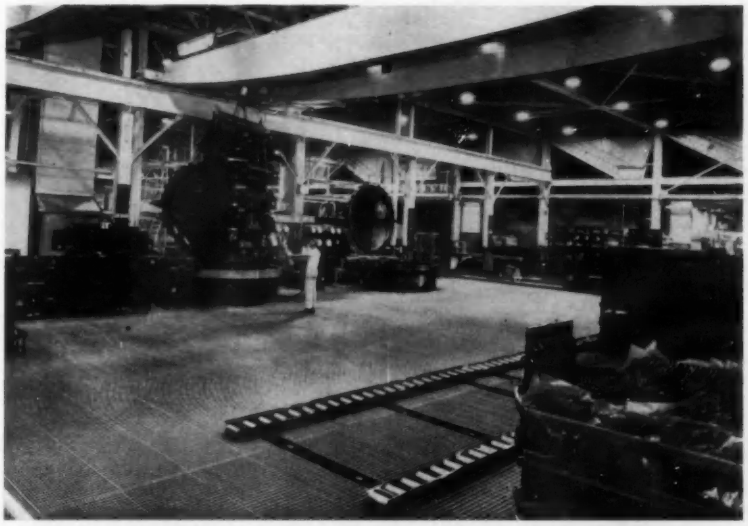
MERCURY PRICES*

	1957	1956
Monterey Series		
Two-Door Sedan	$2,315	$2,158
Four-Door Sedan	2,380	2,213
Phaeton Coupe	2,425	2,283
Phaeton Sedan	2,490	2,348
Convertible Phaeton	2,715	2,493
Montclair Series		
Four-Door Sedan	2,885	2,785
Phaeton Coupe	2,930	2,765
Phaeton Sedan	3,005	2,830
Convertible Phaeton	3,110	2,890
Station Wagon Series		
Commuter Two-Door (six-Pass.)	2,620	....
Commuter Four-Door (six-Pass.)	2,685	2,503
Commuter Four-Door (nine-Pass.)	2,775	2,593
Voyager Two-Door (six-Pass.)	3,085	....
Voyager Four-Door (nine-Pass.)	3,240	....
Colony Park Four-Door (nine-Pass.)	3,340	2,982

* Suggested list prices, not including distribution and delivery charges, preparation charges, Federal excise, state or local taxes, license fees, optional equipment and accessories.

AMC Launches Big Campaign To Boost Metropolitan Sales

Encouraging sales registered by the small Metropolitan car during the past few months have prompted American Motors to place more emphasis on the car next year. The company is shooting for minimum sales of 20,000 units in 1957, or nearly three times the anticipated total of 7500 for 1956 by the latest figures.



L-O-F EXPANDS PLATE GLASS PRODUCTION CAPACITY

Typical of the facilities installed by Libbey-Owens-Ford Glass Co. at its Toledo, O., and Ottawa, Ill., plants for increased polished plate glass production are these huge new autoclaves at the former factory. Used to laminate modern panoramic windshields, the autoclaves apply pressure and heat through the practical medium of oil.

A recent move by the company to place more emphasis on the car was the appointment of a sales manager. Another step which should help boost Metropolitan sales is an agreement by AMC with Austin Motor Co., Ltd., of England, under which the latter's distributors will market the car in most foreign countries. In the past, the car was sold exclusively by Hudson and Nash dealers in the U. S. only.

L. A. Young Earnings Soar To $1.3 Million

The results of the diversification program at L. A. Young Spring & Wire Corp. are reflected in the company's financial report for the fiscal year ended July 31. Earnings for the period rose to $1.39 million from $170,878 in the preceding 12 months. The sum was realized on total sales of $46.02 million.

S-P May Diversify Its Scope Before Curtiss-Wright Merger

Studebaker-Packard Corp. may diversify into non-automotive fields before a possible merger into Curtiss-Wright Corp. According to Roy T. Hurley, Curtiss-Wright board chairman, there are no immediate plans to merge S-P with Curtiss-Wright. All current effort is directed toward building up S-P to a profitable operation. He did not, however, indicate that eventual merger between the two

News of the AUTOMOTIVE

companies was not being considered.

Mr. Hurley did not specify what fields would be considered for S-P but said that several are possible. He also said that Curtiss-Wright is interested in the entire Daimler-Benz line of products. These undoubtedly would be handled by Studebaker-Packard if the deal is made.

He added that S-P will be on a break-even basis late this year or by early 1957. It should be in a profitable position by the end of next year. The improved position of the company is due, he said, to rebalancing schedules, capacity, and budget in relation to a realistic volume.

Mr. Hurley made it very clear, however, that his philosophy about S-P is that it must operate as a self-sufficient economic unit. He added that he does not believe defense contracts should be used to support the automobile side of the business.

1956 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	For Weeks Ending Nov. 17	Nov. 10	Nov. 3	Oct. 27	Total Jan. 1 to Nov. 17, 1956
PASSENGER CAR PRODUCTION					
Hudson	27	143	99	142	21,949
Nash	119	564	468	628	52,727
Rambler	371	1,877	1,494	1,826	16,696*
Total—American Motors	517	2,904	2,061	2,596	91,372
Chrysler and Imperial	2,746	2,081	1,494	906	88,607
De Soto	3,415	2,883	2,522	1,262	84,713
Dodge	4,788	4,118	5,626	3,183	166,754
Plymouth	12,257	10,871	11,536	8,529	375,465
Total—Chrysler Corp.	23,186	19,953	21,178	13,879	715,539
Ford	36,803	37,285	36,071	31,258	1,150,804
Lincoln and Continental	830	870	769	731	42,504
Mercury	5,479	4,133	3,165	2,766	207,619
Total—Ford Motor Company	43,112	42,288	40,005	34,755	1,400,927
Buick	10,056	8,313	5,081	4,764	457,713
Cadillac	1,771	1,289	902	819	119,774
Chevrolet	37,919	39,897	34,196	35,984	1,411,645
Oldsmobile	8,685	7,688	5,651	4,107	372,264
Pontiac	7,765	7,439	5,870	4,989	289,067
Total—General Motors	66,196	64,626	51,702	50,663	2,650,463
Packard	0	0	0	0	13,289
Studebaker	2,841	2,639	2,646	2,518	71,636
Total—Studebaker-Packard	2,841	2,639	2,646	2,518	84,925
Checker Cab	121	105	132	79	3,526
Total—Passenger Cars	135,973	132,215	117,724	104,490	4,946,752
TRUCK PRODUCTION					
Available	4	3	6	5	329
Chevrolet	6,973	7,194	7,054	6,957	311,857
G. M. C.	1,842	1,893	1,920	1,886	81,849
Diamond T	84	104	106	101	4,637
Divco	60	0	0	56	3,161
Dodge and Fargo	1,500	1,731	2,061	2,173	79,412
Ford	5,606	5,348	5,439	5,194	266,672
F. W. D.	68	32	25	24	1,515
International	2,455	2,809	206	2,807	119,624
Mack	386	267	80	412	16,056
Reo	55	89	89	79	3,485
Studebaker	335	382	248	349	13,141
White	304	284	291	333	15,683
Willys	1,564	1,436	1,260	1,340	55,455
Other Trucks	83	89	96	96	5,576
Total—Trucks	21,339	21,689	18,881	21,802	980,654
Buses	39	69	65	42	3,783
Total—Motor Vehicles	157,351	153,973	136,670	126,334	5,931,189

* Prior to week ending Sept. 1, 1956, Rambler production was included with Nash and Hudson.

Ford Selects Name "Edsel" For Its New Line of Cars

Ford has officially settled on the name for its forthcoming new car, commonly referred to as the "E" car during the past year or so. The car will be called the "Edsel," in honor of the late Edsel Bryant Ford. He was the only son of the founder of the company and served as president from 1919 until his death in 1943.

At the same time, the name of the Special Products Div., which will produce the new line of cars, was renamed the Edsel Div. To fall between the present Mercury and Lincoln lines, the Edsel will be introduced next fall.

Studebaker Prices Up 4.7% Above '56 Models

Studebaker prices for 1957 (see AI, Nov. 1, p. 52) are up about 4.7 per cent. Factory list prices range from $1,823 for the six-cylinder Champion custom two-door to $2,433 for a new four-door V-8 station wagon. The increases run from $46 to $164.

Studebaker has added seven new models to bring to 18 the total number offered. Since the company also dropped six models from the line, it is difficult to arrive at a valid comparison in prices between most 1956 and 1957 models.

Some minor revisions were made in the prices of accessories and optional equipment. Power steering was reduced from $100 to $91.12; air conditioning from $459 to $395; and "power packs" (which include dual exhausts and four barrel carburetion) from $55 to $46.58. The non-slip differential, offered as an option on all V-8 models, remains at $32.43.

Reo Scheduled To Receive U. S. Contract For Trucks

Reo Motors, Inc., is in line to receive a $13 million Army Ordnance contract for production of 2½-ton military trucks. A substantial number of the trucks to be produced would be sent overseas under the U. S. Military Defense Assistance program.

AND AVIATION INDUSTRIES

National Automobile Show To Launch Some New Cars

Ending a 16-year absence and resuming a half-century-old tradition, the National Automobile Show is back in New York City. The epic exposition is scheduled to open on Dec. 8 at Manhattan's new Coliseum and will run through Dec. 16.

In all, there will be 124 automobiles representing every American make and 66 trucks and buses on display in the show. A complete synopsis of exhibition plans and events was given in a special preview article appearing in the Nov. 15 issue of AUTOMOTIVE INDUSTRIES.

Described and illustrated here are several new cars and commercial vehicles to be introduced at the exposition. Details on any other new models that were not available at press time will appear in a future issue.

Mercury Turnpike Cruiser

Special attention in the Mercury display will be focused on the new Turnpike Cruiser, which is making its public debut as the top line in the Mercury series for 1957. Comparable in general appearance and incorporating the mechanical innovations found in other Mercury offerings (see AI, Nov. 1, p. 62), the car does, however, embody some distinctive styling features that set it apart from the rest of the line.

One example is a different roof panel treatment with pod air intakes on both sides at the windshield header. Another is a tinted compound curvature windshield, as contrasted with the conventional wrap-around type. The rear window is recessed and is retractable by means of a control at the instrument panel.

Engines are the same as on the rest of the line. The 368 cu in. engine is standard, while the 312 cu in. engine is optional.

(*Turn page, please*)

Captions for illustrations (in order from top to bottom) —(1) Mercury Turnpike Cruiser; (2) Willys FC-150 Truck; and (3) Ford Ranchero.

News of the AUTOMOTIVE

Packard-Clipper for 1957 is first Packard turned out in South Bend, Ind.

Willys FC-150 Truck

A new four-wheel drive truck—the "Forward Control" Jeep FC-150—is being exhibited by Willys Motors, Inc., at the Show.

Powered by the Willys F-head Hurricane 134.2 cu in. engine, the FC-150 offers nine forward and three reverse power combinations. An optional four-speed transmission provides 12 forward power combinations.

Location of the cab well forward of the engine is said to provide a payload bed more than six ft in length, despite the 81-in. wheelbase. Cargo length is 92 in. with tailgate extended.

Ford Ranchero Pick-Up

Spotlighted in the Ford Div. display area will be a somewhat novel departure in commercial vehicle design. The new Ranchero resembles a Ford automobile from the front bumper to its mid-point. From that point rearward, however, the roof is cut off to form a cab, and a low truck bed is set into the rear section.

The Ranchero is 16 in. lower and 18 in. longer than a conventional 1956 Ford pickup truck. It is said to have a payload capacity of nearly three-quarters of a ton.

Offered with either standard, overdrive, or automatic transmissions, the trucks come in two models. The Ranchero is powered by a 272 cu. in., 190-hp V-8, while the Custom Ranchero has a 292 cu in., 212-hp powerplant. Each is also available with a 144-hp Six.

GMC Highway Tractor

GMC Truck and Coach Div. will be on hand with a new highway tractor. It has air suspension, lightweight aluminum construction fea-

(*Turn to page* 138, *please*)

Cadillac Eldorado Brougham combines host of luxury features throughout.

Chrysler Line Hiked $31—$302; Prices Down On Some Imperials

Chrysler Div. has increased prices from between $31 and $302 on its 1957 line (see AI, Nov. 1, p. 71). Five new models have been added to the Imperial line of cars to result in price decreases ranging from $81 to $447 on the lower bracket Imperials.

CHRYSLER PRICES*

Windsor Series	1957	1956
Two-Door Hardtop	$2,817	$2,765
Four-Door Hardtop	2,877	2,846
Six-Passenger Sedan	2,757	2,606
Saratoga		
Two-Door Hardtop	3,372	....
Four-Door Hardtop	3,444	....
Six-Passenger Sedan	3,338	....
New Yorker Series		
Two-Door Hardtop	3,776	3,650
Four-Door Hardtop	3,829	3,749
Six-Passenger Sedan	3,749	3,449
Convertible Coupe	4,182	3,880

IMPERIAL PRICES*

Imperial Series	1957	1956
Four-Door Sedan	$4,347	$4,423
Two-Door Southampton	4,252	4,672
Four-Door Southampton	4,347	4,794
Imperial Crown Series		
Four-Door Sedan	4,869	....
Two-Door Southampton	4,741	....
Four-Door Southampton	4,869	....
Convertible Coupe	5,047	....
Imperial LeBaron Series		
Four-Door Sedan	5,168	....

* Suggested factory retail prices, excluding dealer charges, Federal excise, state, and local taxes, license fees, or optional equipment and accessories.

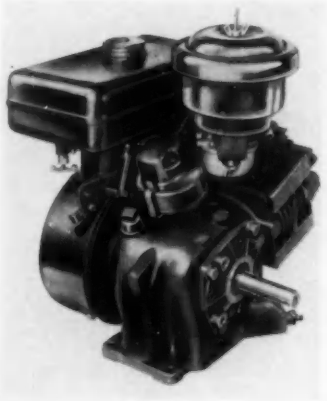
1956 Car Output Now Pegged At 5.7 To 5.8 Million Units

All hopes for production of six million cars this year appear to have faded. Output through mid-November totaled only 4.95 million units.

The industry would have to turn out more than one million cars in the remaining six weeks to achieve its original six million goal. An average of approximately 175,000 a week would be required.

It appears that output will level out at about 150,000 cars a week in the remaining four weeks. On that basis, the industry will wind up the year with between 5.7 million and 5.8 million cars for the fourth best year.

AND AVIATION INDUSTRIES



CONTINENTAL ENGINES

Continental Motors Corp. has broadened the power range of its Red Seal industrial aircooled engine line with the addition of heavy-duty four-hp models of both conventional and vertical shaft design. They are designated respectively as the Model AU10 (shown above), Model AD10, and Model AW10. Piston displacement is 9.82 cu in., and compression ratio is 6.25 to 1 with four-hp output.

Vornado Air Conditioner Produced for Newer Cars

An automobile air conditioner that will be produced in volume and sold on a nationwide basis through appliance stores, as well as present retail outlets, was announced at a recent press conference in New York City by O. A. Sutton Corp.

The new Vornado unit, which is sold as a complete package, has been designed to fit into any 1955, 1956, or 1957 car. It has been engineered to provide instant cooling action and good efficiency, both in slow city traffic or on the open road.

The air conditioner has five individually adjustable air circulators and a thermostat, which automatically controls the cooling temperature. Cooling coils are housed in a compact cabinet under the dash.

A Tecumseh compressor, which operates off the flywheel, is mounted on the motor block. Fan motor is three-speed, series wound 1/20 hp; air volume capacity is 250 cfm. High speed on blower is 2600 rpm; medium speed, 2400 rpm; and low speed, 2100 rpm.

(*Turn to page* 154, *please*)

AI TABLOID

Boeing Airplane Co. has signed a purchase option on Ford Motor Co.'s former assembly plant at Richmond, Calif.

* * *

Fine Tubes, Ltd., an affiliate of Superior Tube Co., has acquired Moray Engineering Co., Ltd., of England.

* * *

Aro Equipment Corp. has announced a new $2.5 million expansion program. . . . Carborundum Co. plans to spend $30 million for plant expansion in 1957 and 1958.

* * *

Chandler-Evans Div. of Pratt & Whitney Co. has opened a new sales and engineering office in Hollywood, Calif.

* * *

Goodyear Tire & Rubber Co. recently produced its 700,000,000th pneumatic tire. The company also disclosed that its Captive-Air safety tire is now being produced in 14-in. sizes.

* * *

Vibrator Div. of P. R. Mallory & Co., Inc., is now operating in a new plant located in DuQuoin, Ill.

* * *

Lord Manufacturing Co. has set up a Special Products Div. . . . Twin Coach Co. is setting up a new Aeronautical Engineering Div. in Cheektowaga, N. Y.

* * *

Goodrich International Rubber Co. recently dedicated its new plant near Manila, the Philippines.

* * *

Bell Aircraft Corp. has formed two new operating divisions to replace the existing Niagara Frontier Div. They will be known as the Aircraft Div. and the Weapons System Div.

* * *

George K. Garrett Co. recently broke ground for its new $2.5 million plant in Philadelphia, Pa.

Waterbury Farrel Foundry & Machine Co. has acquired the Sendzimir cold rolling mill interests of Armzen Co.

* * *

Hydair Cylinder Corp. is name of new company formed in Cudahy 7, Wis., to produce air cylinders.

* * *

AMP, Inc., is new name of Aircraft-Marine Products. . . . Swanson-Erie Corp. is new name of Swanson Tool & Machine Products, Inc.

* * *

Du Pont Co. is studying the possibility of increasing by approximately 30 million gal a year its production of methanol.

* * *

Bucyrus-Erie Co. plans to build a $12 million drill manufacturing plant near Richmond, Ind. . . . Automatic Temperature Control Co. will build a new 70,000 sq ft plant in King of Prussia, Pa.

* * *

Sutter Products Co. has moved to Holly, Mich.

* * *

Stockholders of Universal Corp. have approved purchase of the assets of Marion Power Shovel Co. and Osgood Co. . . . Pettibone Mulliken Corp. is acquiring Mercury Manufacturing Co.

* * *

Dewey and Almy Chemical Co. Div. of W. R. Grace & Co. is constructing a new pilot laboratory.

* * *

Vertol Aircraft Corp. has initiated an aggressive sales program in Europe, South America, and the Far East.

* * *

Seiberling Rubber Co. is observing the 35th anniversary of its founding this month. . . . Caterpillar Tractor Co. is marking the 25th anniversary of its mobile heavy-duty Diesel engine this month.

(*Turn to page* 137, *please*)

Men in the News

Chambersburg Engineering Co.—Samuel C. Clarke is now manager of sales.

LaSalle Steel Co.—**T. Lloyd Kelly** has become chairman of the board and **Thomas A. Kelly** has been elected president and chief operating officer.

AC Spark Plug Div., General Motors Corp.—**Hubert L. Curtis** and **Howard L. Roat** were named works manager and manufacturing manager, respectively, of the Flint, Mich., plants. **Howard W. Brandt** was chosen director of sales and contracts for the Milwaukee, Wis., plants, and **Warren E. Milner** was made manager.

Electric Auto-Lite Co.—**J. Turner Moore, Jr.**, was elected a vice-president.

Dana Corp.—**A. G. Leber** was named axle sales manager.

American Motors Corp.—**J. L. Brown, Jr.**, has been elected secretary, and **L. M. Pursley** has been promoted to national business management manager.

Rochester Products Div., General Motors Corp.—**Wallace E. Wilson** has been appointed general manager.

Carmet Div., Allegheny Ludlum Steel Corp.—**George M. Chandler** has been named sales manager.

Vanadium Corp. of America—**Howard H. Wilder** has been appointed manager of engineering sales.

Yale Materials Handling Div., Yale & Towne Manufacturing Co.—**Clyde R. Dean Jr.**, has been promoted to general sales manager; and **Francis J. Dunleavy** has become assistant general manager.

Ford Motor Co., Steel, General Products and Manufacturing Services Divs.—**S. W. Ostrander** was named vice-president for special assignments and **K. D. Cassidy** was made group executive.

Standard Tube Co.—**Thomas F. Marlow** was appointed vice-president in charge of engineering, and **Buford S. Wiseman** was named vice-president in charge of manufacturing.

Conoflow Corp.—**Albert J. Hanssen** has been appointed chief engineer.

Buick-Oldsmobile-Pontiac Assembly Div., General Motors Corp.—**James H. Allen** was made manager of the Kansas City, Kans., plant.

Michigan Tool Co., Machine & Tools Div.—**Irvin R. Spangler** has been appointed assistant sales manager.

Willys Motors, Inc.—**C. W. Grinstead** has been appointed director of advertising and merchandising.

Chrysler Div., Chrysler Corp.—**Lloyd S. McCune** has been named general operating manager; **G. T. Poirer**, general manufacturing manager; **M. T. O'Donnell**, programming manager; **A. E. Krass**, production manager; and **F. A. Stewart**, production control manager.

Landis Tool Co.—**J. J. Keane** has been named assistant general sales manager.

Philco Corp., Automotive Div.—**Lionel M. Searle** has been appointed vice-president and general manager.

Hercules Motors Corp. — Walter L. Brough has been elected executive vice-president.

Moraine Products Div., General Motors Corp.—**Norman L. Gebhart** and **John W. Quinn** have been promoted to director of purchasing and material control and general superintendent of manufacturing, respectively.

Climax Molybdenum Co.—**H. W. Schultze** is now assistant manager of Chemical development.

Aro Equipment Corp., Lubricating Equipment and Air Tool Div.—**W. D. Nixon** has been promoted to purchasing agent.

Lockheed Aircraft Corp.—**L. Eugene Root** was appointed vice-president and general manager of the Missile Systems Div.

Gits Bros. Manufacturing Co., Shaft Seal Div.—**William Kujala** is now Eastern District sales manager.

Cleveland Cap Screw Co.—**Francis P. Blonska** has been made administrative assistant in sales.

Dana Corp. — L. L. Dodge has been appointed assistant general sales manager.

General Motors Corp.—**John Q. Holmes** was chosen director of the Production Engineering Section at the GM Technical Center.

Firth-Loach Metals, Inc. — **E. J. Reitler** has become assistant sales manager.

Pontiac Coach Co.—**Raymond E. Danto** has been elected president and chief executive officer.

Hycon Mfg. Co.—**William Q. Nicholson** has become chief staff engineer.

(*Turn to page* 145, *please*)

Necrology

Robert J. Woods, 52, a cofounder and director of engineering and sales for Bell Aircraft Corp., died Nov. 3, at Buffalo, N. Y.

Newman M. Marsilius, 66, chairman of the board of Producto Machine Co., died Oct. 17, at Bridgeport, Conn.

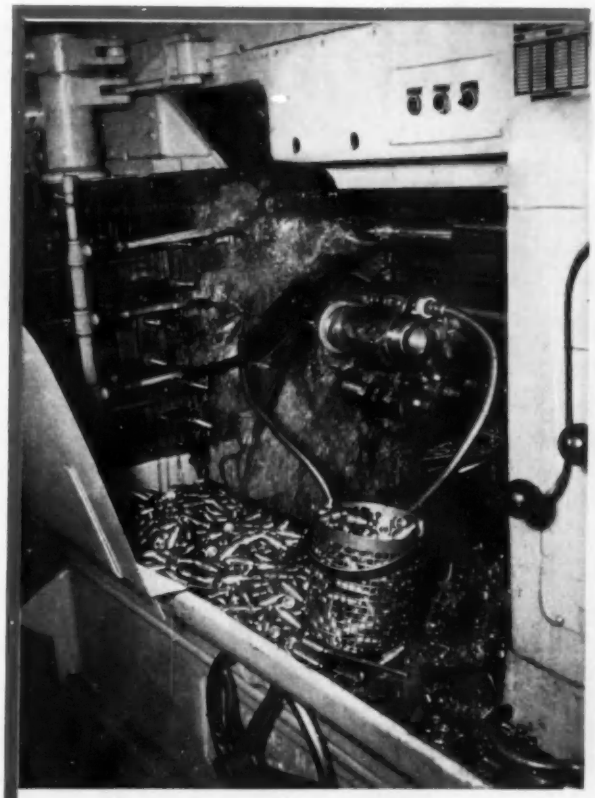
Robert W. Lea, 70, retired president of Johns-Manville Corp., died recently, at New York, N. Y.

Ralph N. Long, 59, assistant controller of General Motors Corp., died recently, at Ann Arbor, Mich.

James Kniveton, 58, vice-president of Selas Corp. of America, died Nov. 12, at Philadelphia, Pa.

Paul A. Meyer, 64, vice-president in charge of engineering for Michigan Oven Co., died recently, at Detroit, Mich.

James R. Adams, 58, chairman of the board of McManus, John & Adams, Inc., died Nov. 5, at Detroit, Mich.



Better Machining from stock to finish

for Blackstone Corporation, Jamestown, New York

The nation's oldest manufacturer of washing machines, dryers and ironers, Blackstone, uses a sizable battery of automatics for its machining. For years, lubrication with Texaco has helped achieve an enviable record of trouble-free production with economical unit costs.

Dual-purpose *Texaco Cleartex Oil AX*, for example, is used in automatics as cutting fluid and machine lubricant. The results—extra-long tool life, consistently rust-free finish, lasting undiluted strength of the cutting oil, effective protection for machines.

There is a complete line of *Texaco Cutting, Grinding* and *Soluble Oils* to help you do *all* your machining better, faster and at lower cost. Let a Texaco Lubrication Engineer help you choose the ones best suited to your needs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

Which Through-Hardening Grade of Alloy Tubing Is Best for You?

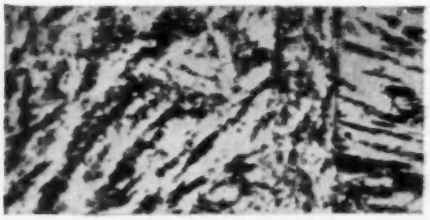
. . . B&W Can Supply Them All

For applications of mechanical tubing that require high strength, ductility, and resistance to impact, the medium-carbon, through-hardening steels are particularly suitable. A correlation of the properties of each available grade with your product specifications will help you determine the grade most suitable for your operation. Listed are the medium-carbon alloy steels typical of those that can be heat-treated to meet a broad range of mechanical properties. These steels all contain alloying elements introduced to provide a desirable combination of strength and ductility and to promote ease of heat treatment. In some grades the alloying elements also provide resistance to softening at higher tempering temperatures.

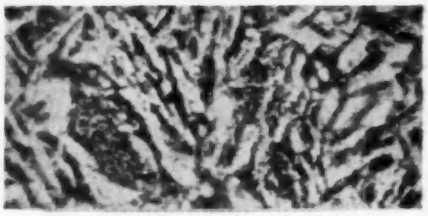
Tubing of these grades may be hot forged without difficulty by conventional methods, and in the softened state is readily machinable—a good indication of the workability common to all the medium carbon through hardening.

In the application of alloy tubing of these steels, it is often possible to use alternate grades without loss of desirable mechanical properties. You'll find Mr. Tubes—your link to B&W—always on call and invariably helpful in any discussion of your tubing requirements. You'll find B&W Bulletin TDC-141 helpful, too. Send for your copy today. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

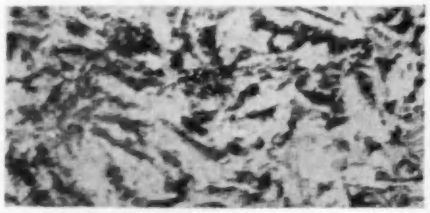
Typical Microstructures (at 1000 X) and Hardnesses, 4140 Steel



Hot Rolled — Hardness 285 BHN



Normalized 1650 F — Hardness 302 BHN



Normalized 1650 F and drawn at 1250 F for 1 hour — Hardness 217 BHN

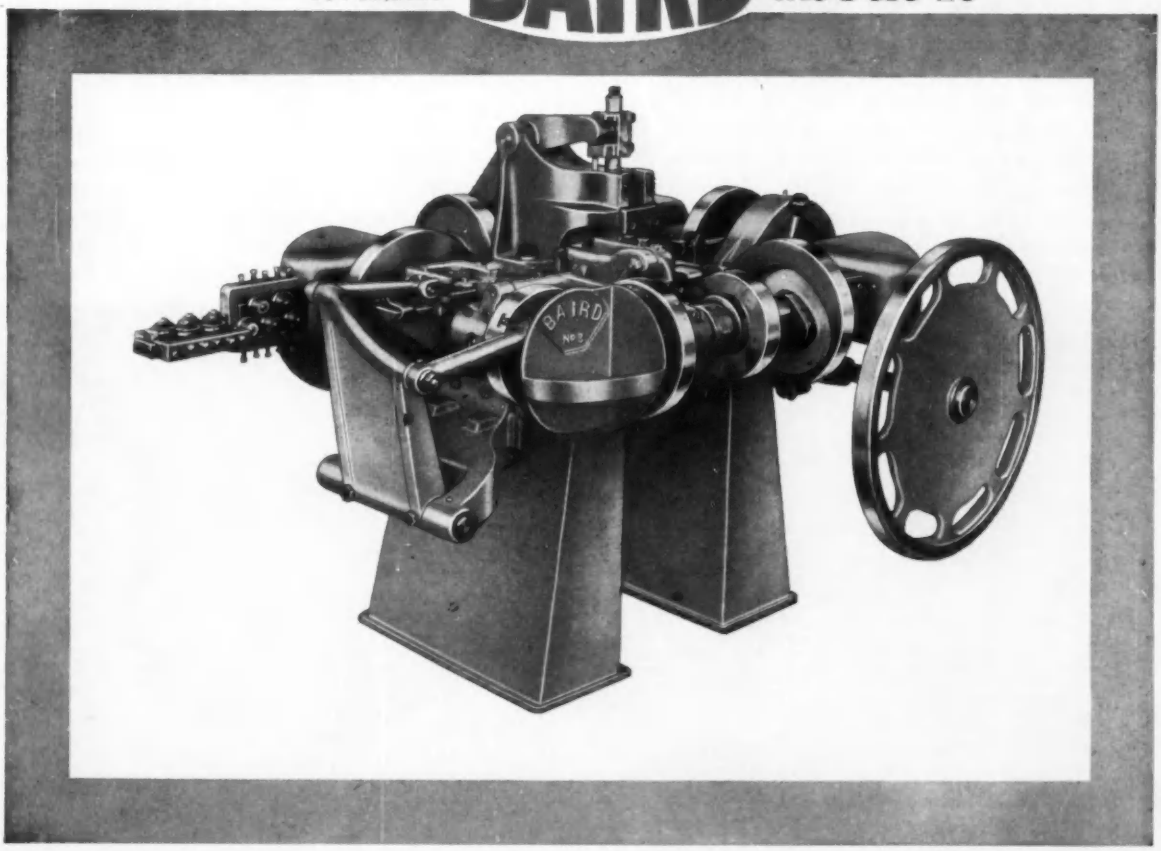
TYPICAL THROUGH-HARDENING GRADES

1340	2340	3140
4042	4140	4340
4640	5140	8640
8740	9440	

TA-6101M

Seamless and welded tubular products, seamless welding fittings and forged steel flanges—in carbon, alloy, and stainless steels

...ask BAIRD about it



The "hidden bargain" in a BAIRD Four-Slide

Thousands of Baird Four-Slide users . . . making everything from auto seat springs to bobby pins . . . say it isn't hard to find.

The "hidden bargain" is the cost-reduction know-how that goes along with every machine sold.

Baird pioneered the four-slide machine as the basic round and ribbon wire forming equipment used by every industry making such products. Baird has the most extensive experience files on tooling for this most versatile of high production equipment. Usually the problem that seems tough to the customer can be matched to a previous successful Baird application . . . thereby saving time and money in tooling.

With such a reservoir of past practical experience to draw upon, it's always good business to "ask Baird about it" when a four-slide application is being considered. Our range of standard automatic wire forming machines is complete, from the "bench top" No. 00 (400 lbs.) to the "room size" No. 8 (12,000 lbs.) . . . also two standard sizes of ribbon metal forming machines. Bulletin on request. Write Dept. AI.

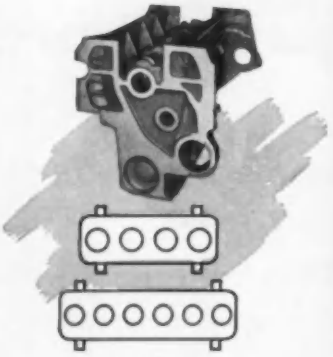
AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

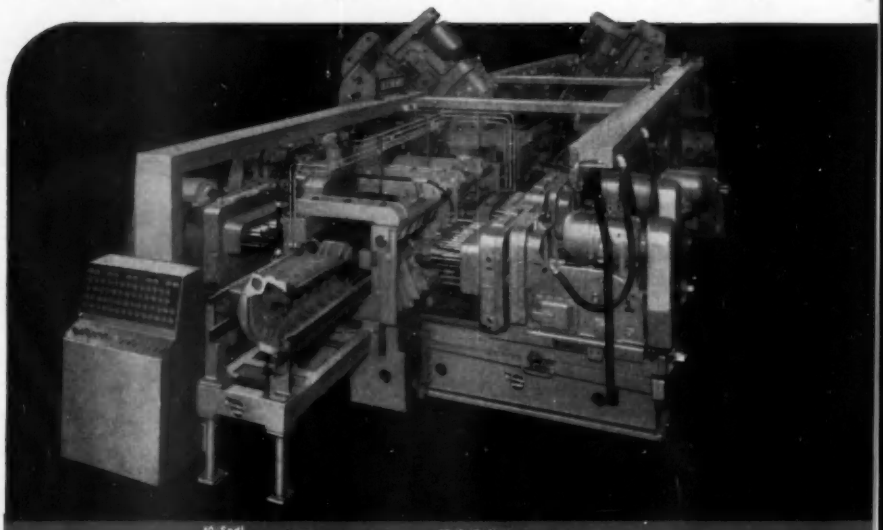
IBA56

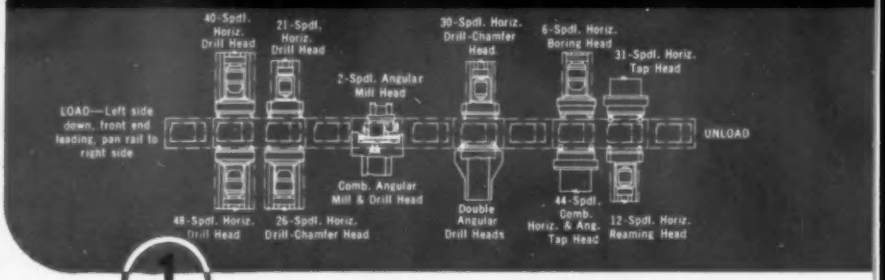
DUAL-PURPOSE SPECIALS . . .

● Here's another outstanding example of how W. F. & John Barnes Coordinated Creative Engineering and Manufacturing Service has helped cut production costs . . . this time for a well-known farm equipment manufacturer. These three special machines have been ingeniously designed to machine TWO SIZES of tractor engine blocks . . . double-duty performance that not only means a lower original investment, but also simplifies tooling, reduces floor space requirements, and increases over-all production efficiency. Careful planning of tooling and machine components holds change-over time to a minimum . . . in fact,



Both 4 and 6-cylinder blocks are processed on the same Barnes' Special Machines.




40-Spdl. Horiz. Drill Head
21-Spdl. Horiz. Drill Head
2-Spdl. Angular Mill Head
30-Spdl. Horiz. Drill-Chamfer Head
6-Spdl. Horiz. Boring Head
31-Spdl. Horiz. Tap Head
LOAD—Left side down, front end leading, pan rail to right side
UNLOAD
Comb. Angular Mill & Drill Head
48-Spdl. Horiz. Drill Head
26-Spdl. Horiz. Drill-Chamfer Head
Double Angular Drill Heads
44-Spdl. Comb. Horiz. & Ang. Tap Head
12-Spdl. Horiz. Reaming Head

1 Barnes 11-Station Progress-Thru Machine completes drilling, tapping, and milling operations on the 4 and 6-Cylinder Diesel Engine Blocks. Bushing plates, guide rails, head stops, transfer pusher fingers, and other machine components are quickly adjustable to handle both block sizes.

SAVE TIME WITH BARNES' COORDINATED 6-POINT BUILDING SERVICE

"Shopping around" is often a costly, time-consuming task, and all too often the results are disappointing . . . that's why Barnes offer a complete machine tool building service from *one convenient source* . . . it saves time and cuts costs because all the work is coordinated in one plant. Barnes' service includes:

1. **SPECIALIZED MANUFACTURING FACILITIES**—75-year background, large well equipped plant efficiently tooled to build high production machines.
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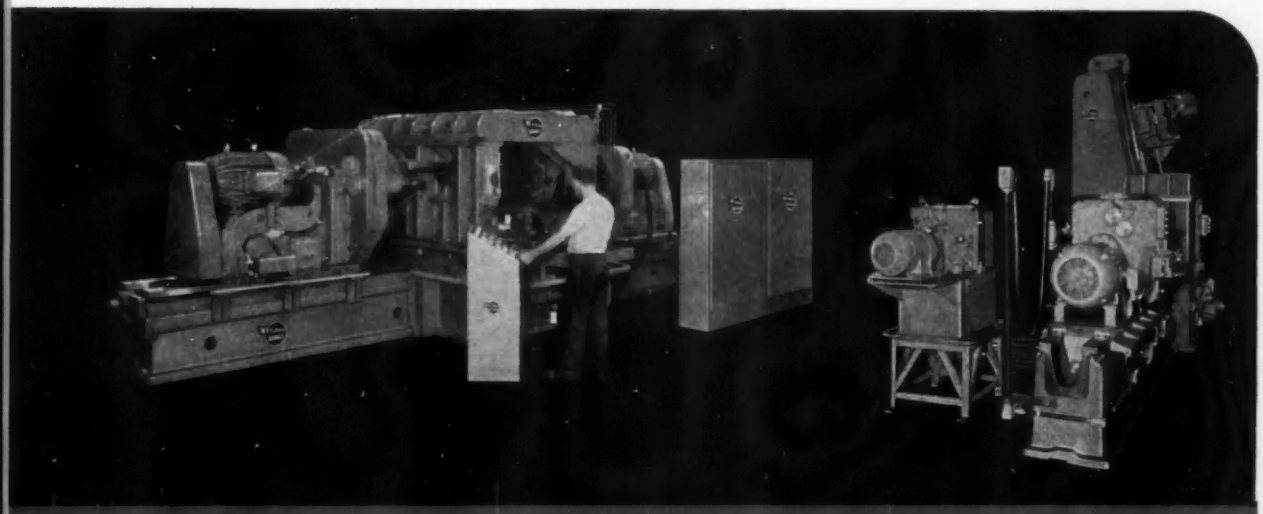

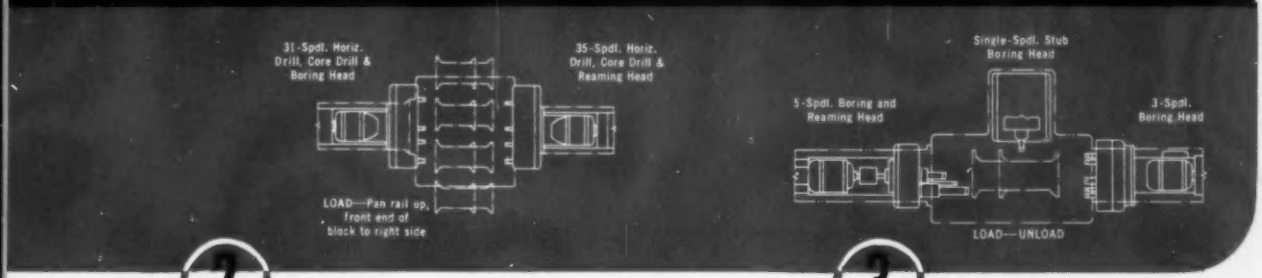
31-Spdl. Horiz. Drill, Core Drill & Boring Head
35-Spdl. Horiz. Drill, Core Drill & Reaming Head
LOAD—Pan rail up, front end of block to right side
Single-Spdl. Stub Boring Head
5-Spdl. Boring and Reaming Head
3-Spdl. Boring Head
LOAD—UNLOAD

2 **Barnes Special 4-Station Progress-Thru Machine completes drilling, boring, and reaming on the blocks. Here again, adjustable features are built in to compensate for the two block sizes. Electrical interlocks on these machines prevent accidental tool damage during change-over. Idle stations are included for future tapping operations.**

3 **Special 3-Way Cam and Crank Boring Machine precision bores both block sizes. Adjustment features are similar to the preceeding machines. All units are electrically controlled for automatic cycle sequence with push-button operation.**

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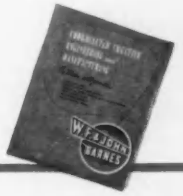

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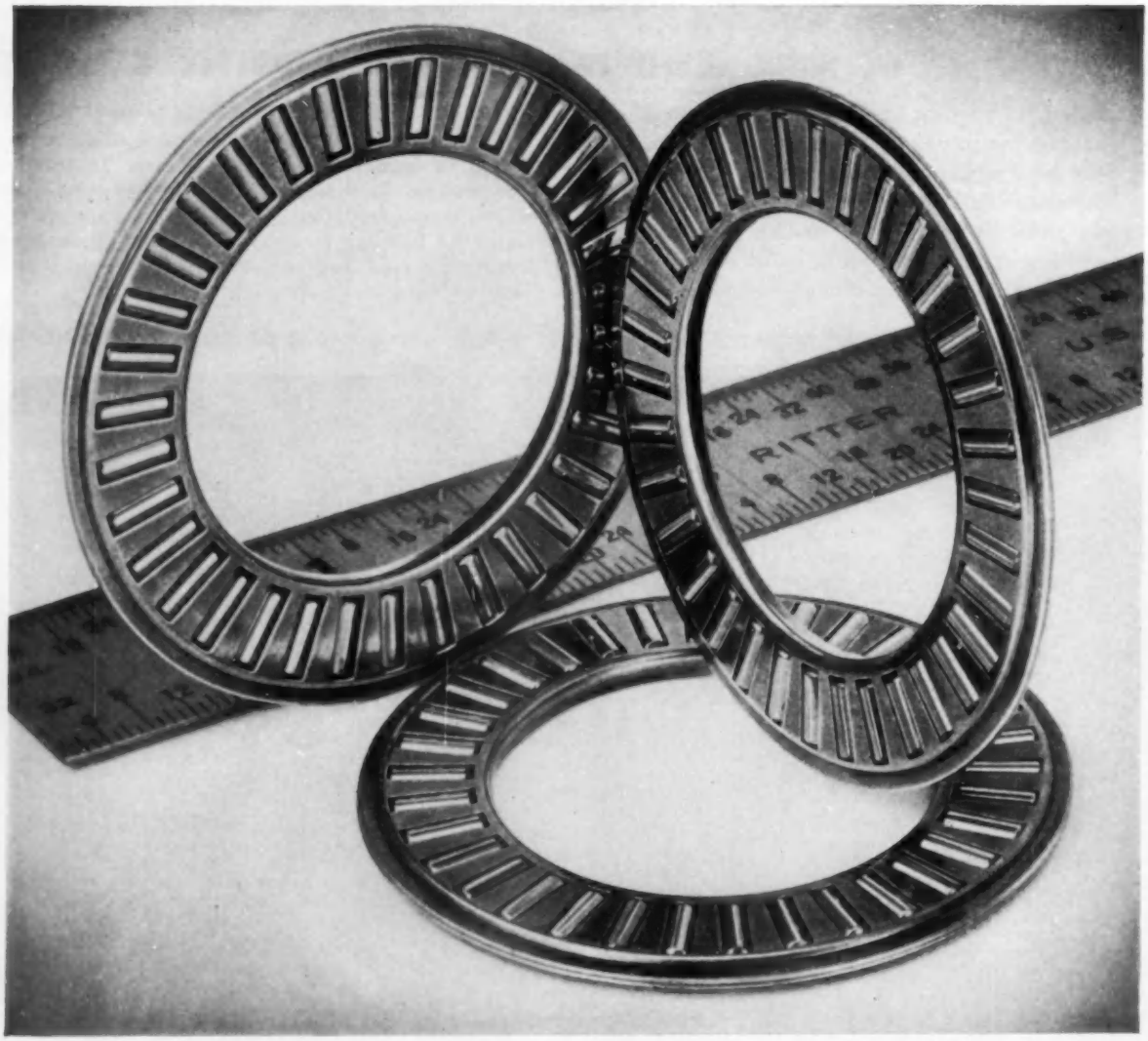

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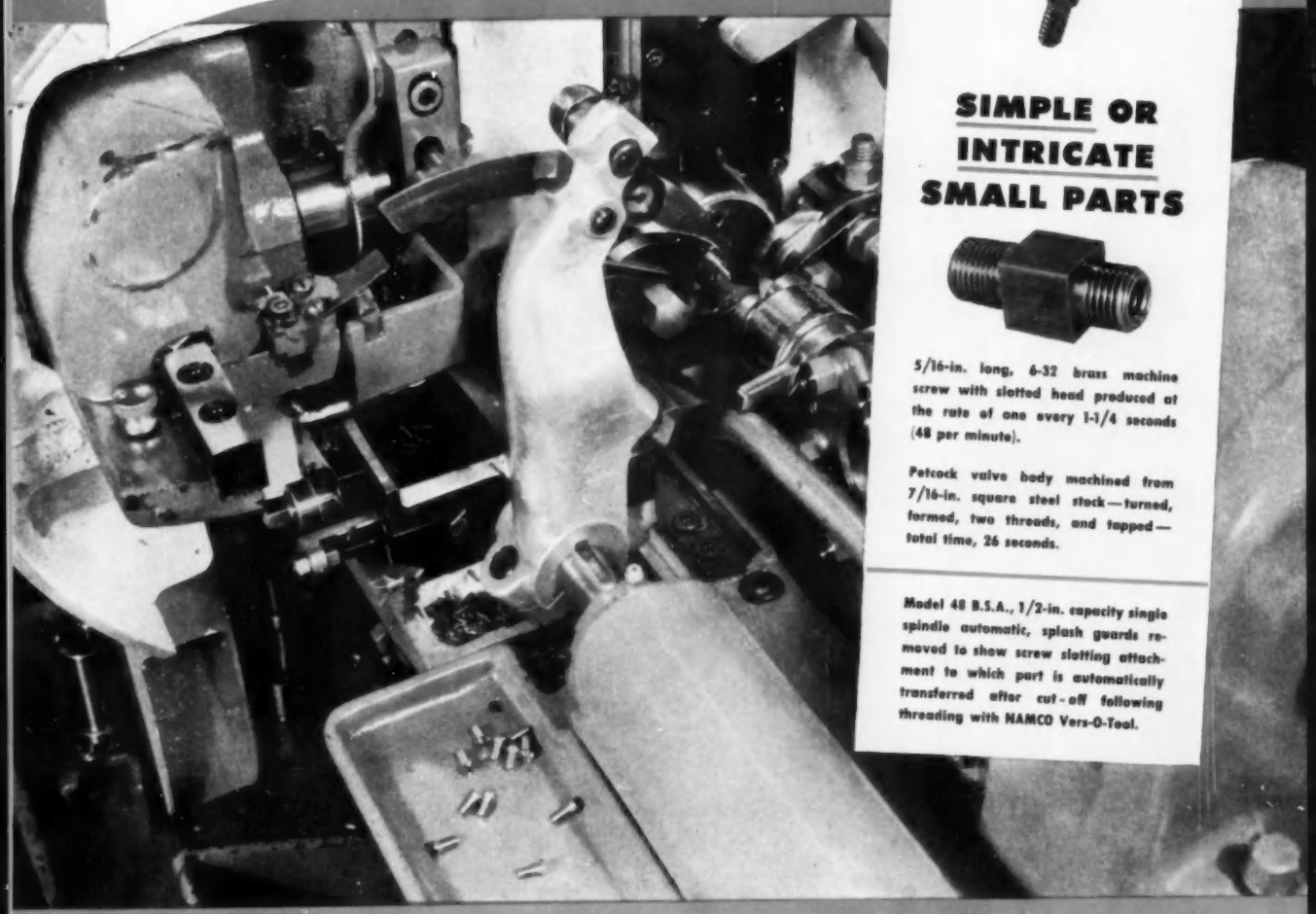

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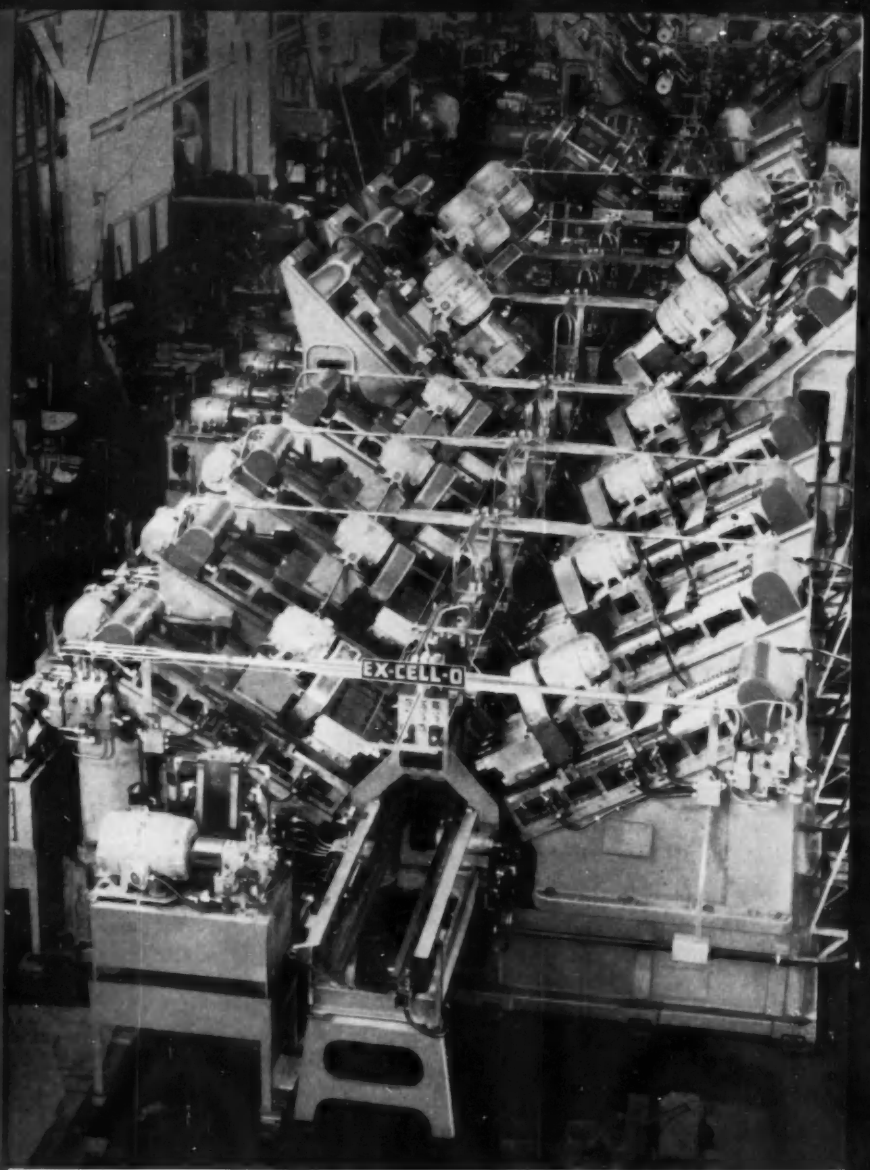

The photograph above is a view in the auto plant shortly after the automation line was installed. At right above, a portion of the line as it neared completion in the Ex-Cell-O plant.

These Ex-Cell-O automation machines play an important part in turning out engine blocks for one of the "big three" of the automotive industry. This manufacturer's engine must compete in one of the toughest markets in the world.

Ex-Cell-O's part in the manufacturing process is 1200 feet of production line using the newest machines in assembled integrated units. Among the precision machining operations performed are boring, broaching, chamfering, milling, reaming and grooving.

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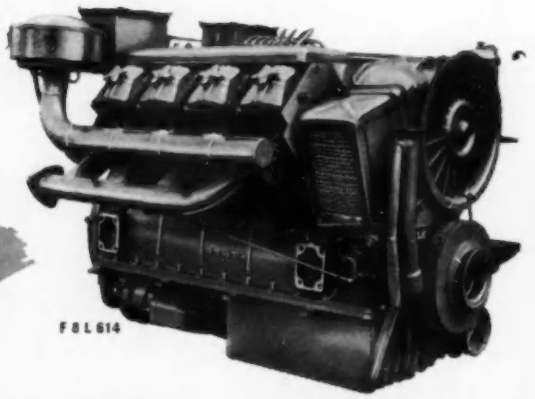
✓ Greater Fuel Efficiency

✓ Less Down Time



F 8 L 614

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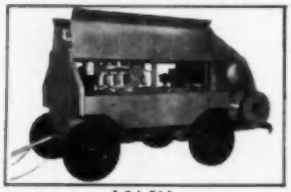

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MODEL	CONT. BHP/CONT. RPM
F 1 L 612	9/1800
F 2 L 612	18/1800
A/F 2 L 514	30/1600
A/F 3 L 514	45/1600
A 4 L 514	60/1800
A 6 L 514/614	90/1800
A 8 L 614	120/1800
A 12 L 614	180/1800

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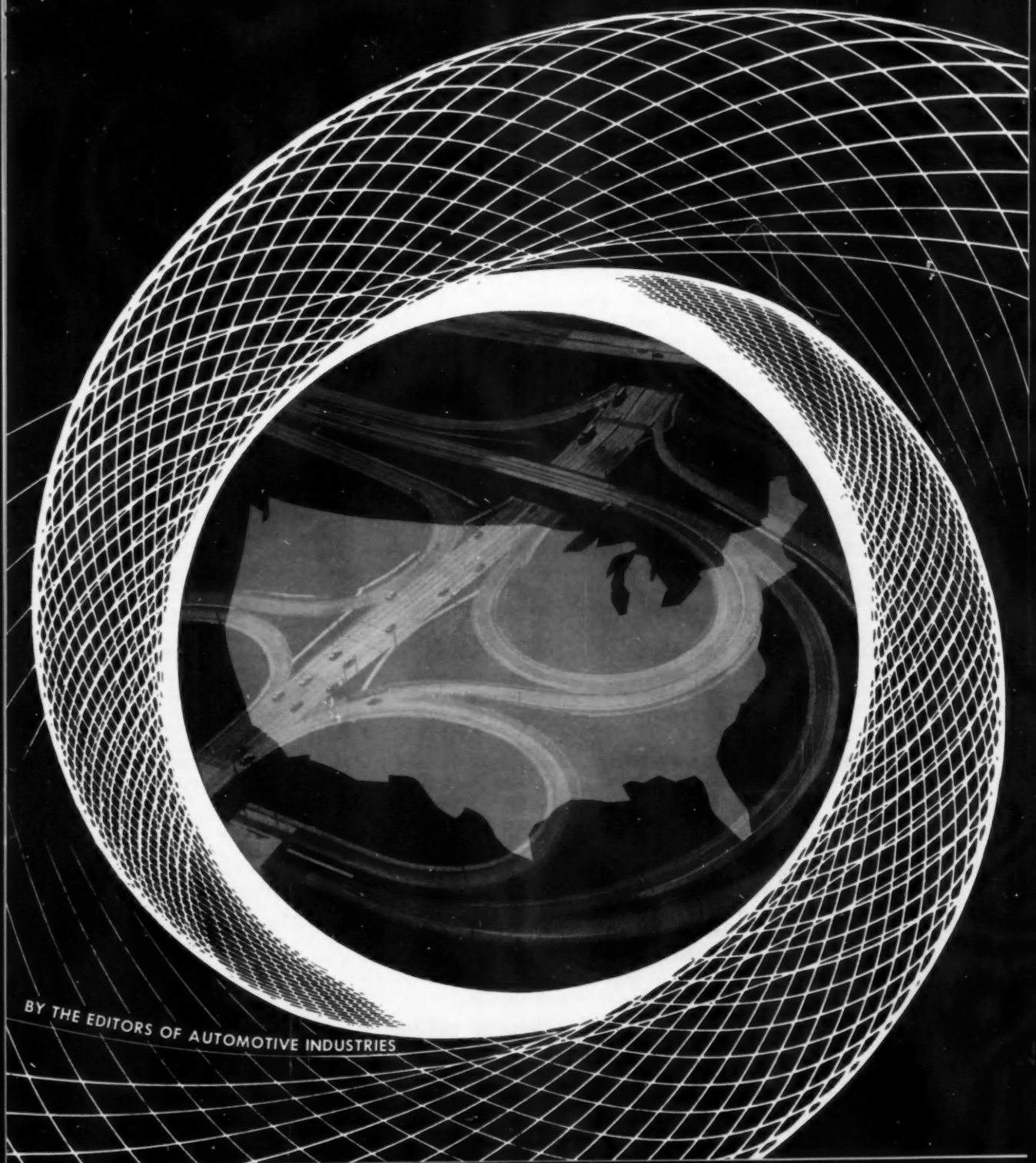
The NEW AMERICA That's Coming

THIS SPECIAL REPORT FORECASTS TREMENDOUS IMPACT OF NATIONAL SUPERHIGHWAY PROGRAM ON INDUSTRY, COMMERCE AND VEHICLE DESIGN



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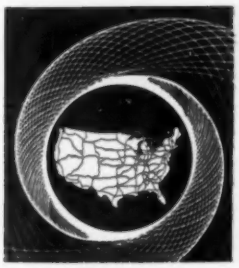
The New America
That's Coming



EXPRESSWAY HORIZONS

By James R. Custer

THE YEAR OF 1970. It appears far away—13 long years by the calendar. Actually it is much closer in terms of progress that will result from the new National System of Interstate and Defense Highways. That is the year this nationwide network is to be in full operation and its capacity is planned to provide for the types of vehicles and volume of traffic in 1975.

This multi-billion dollar public works program, the greatest in all history, has started and will be well underway in 1957. Some benefits will be immediate and many others will accrue from year to year.

Through the centuries—paths, trails, roads, and highways have been the forerunners for human progress. They are basic forms of communication and transportation. Their growth has paved the way for the expansion of industry, commerce and agriculture. Now we are taking the next step forward—a network of superhighways, city by-passes and freeways, linking together the entire nation.

The impact of this highway construction program is certain to result in a vast transformation of the economy of the United States. Every segment will be affected by it. All this will mean a much stronger nation economically and defensively.

In the next 15 to 20 years our nation will be entirely unlike what exists today. Great as have been the achievements of the past, the most spectacular era is just ahead. Its real significance and scope challenge the imagination.

Requirements for machinery, materials and manpower will be enormous for the national highway program. It also will provide numerous indirect benefits. Interest will be stimulated in modernizing the several hundred thousand miles of existing highways. Federal Government expenditures on the interstate system will release State funds for urban, primary and secondary highways, which include the farm-to-market roads. As the public becomes aware of the advantages of the interstate system of superhighways, there is every likelihood that the projected program of 41,000 miles will be enlarged substantially.

Highway transportation, vital as it is today, will be even more so in the future. The national expressways will establish new operating conditions for vehicles. With safety measures incorporated in the highways, average speeds will be higher, daily and trip mileages longer. More emphasis will be placed on operating economically at higher cruising speeds. Out of these new conditions will evolve new designs in passenger cars and commercial vehicles.

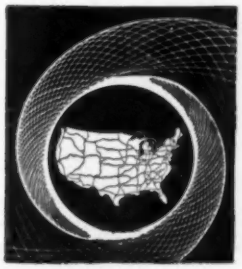
Industrial and residential developments, and other factors, will result in increasing the demand for motor vehicles in addition to the effects of population growth. Two-car families will be as common as single car families. Motor transport and bus transportation will establish new records. Average yearly mileages of vehicles will increase. Whatever the petroleum problem confronting the nation, science and industry will solve it. Likewise, there will be new methods developed for the inspection, servicing and repair of expressway vehicles.

Direct and indirect effects of the superhighway system as it grows will penetrate through almost every segment of the national economy and raise them to a higher level. The pattern of business will undergo many changes. Most current markets will expand, some will shrink or disappear, and new markets will emerge. It will be necessary for companies and other business firms to be alert to this situation and maintain continuous investigation.

Only in a free economy of opportunity and enterprise will these achievements be possible.

The New America That's Coming is portrayed in this series of special articles by a team of editors from the editorial staff of AUTOMOTIVE INDUSTRIES. Data, illustrations and other information were gathered by interview and research from the most authoritative sources in industry, Government and trade associations active in the national highway program. We are indebted to a large group of individuals who contributed generously to the project. The material was screened for the most significant facts, thoroughly analyzed for trends and future effects, then compiled into the following nine reports. Extra copies of this series have been printed and limited quantities are available upon request.

THE NEW AMERICA



SUPERHIGHWAYS FOR TOMORROW

THAT'S COMING

By R. M. Stroupe

41,000-Mile Interstate System to Speed Motor Vehicle Travel; Manpower, Machines, and Materials Required for Vast Network

WHEN PRESIDENT EISENHOWER signed into law on June 29 the Federal Highway Act of 1956, he laid the groundwork for the most ambitious public works program since the 50,000-mile network built over a 500-year period by the Emperors of Rome. Nominally pegged at $33.1 billion over the next 13 years, this gigantic undertaking may eventually result in the expenditure of up to $100 billion in Federal and state funds for expansion of the current program.

Backbone of the new program is a 41,000-mile system of Interstate superhighways linking together major and medium-sized centers of population and industry. Reinforcing this basic Interstate grid will be a vast number of modern urban expressways and rural roads designed to promote greater commercial and distributive progress.

Price tag placed on the Interstate System alone is $27.6 billion (the remainder of the $33.1 billion total represents increased Federal funds for new roads on the three regular Federal-aid highway systems—primary, secondary, and urban). The Federal share of funds for the Interstate System is 90 per cent, or nearly $25 billion. The remainder is to be put up by the states. Federal money is to be derived from a highway trust fund composed in part of revenues from excises, new or increased, on vehicles, petroleum products, tires, and camelback.

New money for roadbuilding that the Government expects to get from these levies by mid-1972 comes to nearly $15 billion. About $1.5 billion is to be brought into the fund in this first year of the program. A "watchdog" arrangement exists to prevent the deficit spending of federal funds for highways in any given year.

Federal funds for the primary, secondary, and urban roads must be matched, dollar for dollar, by the individual states. The amounts that the national Government will provide for this construction will rise from $825 million in 1957 to $850 million in 1958 and $875 million in 1959. Even if this contribution levels off at $900 million a year thereafter, the Federal share of the costs through 1969 will be considerably more than $11 billion.

In keeping with the importance of the program in

TODAY—TOLL ROADS IN OPERATION AND UNDER CONSTRUCTION

bringing the highways of the nation up to standards that will be necessitated by the traffic volumes of 1975, a Federal Highway Administrator has been named to run the vast operation. Appointed overseer of the $33 billion program in October was Bertram D. Tallamy, chairman of the New York State Thruway Authority. Mr. Tallamy, widely known highway expert, will become chief policymaker for the project early in 1957; responsibility for detailed operational management is to remain with the Commissioner of Public Roads.

INADEQUATE ROADS COST MOTORISTS MORE THAN $5 BILLION PER YEAR

	INTERSTATE SYSTEM	OTHER ROADS & STREETS
Traffic Accidents	$1.0 BILLION	$700 MILLIONS
Commercial Vehicle Time Losses	$900 MILLIONS	$900 MILLIONS
Losses in Gasoline Brake, Tire Economy	$700 MILLIONS	$600 MILLIONS
Vehicle Operating Costs on Earth-Gravel Roads Scheduled for Surface Betterments		$500 MILLIONS
TOTALS	$2.6 BILLIONS	$2.7 BILLIONS

Source: Automobile Mfrs. Assn.

APPEARANCE OF THE SYSTEM

Coordinated planning by state highway authorities and the U. S. Bureau of Public Roads has produced a set of geometric design standards for highways on the Interstate System. Construction in keeping with these criteria is to create a uniformly sound network of high-speed superhighways throughout the country.

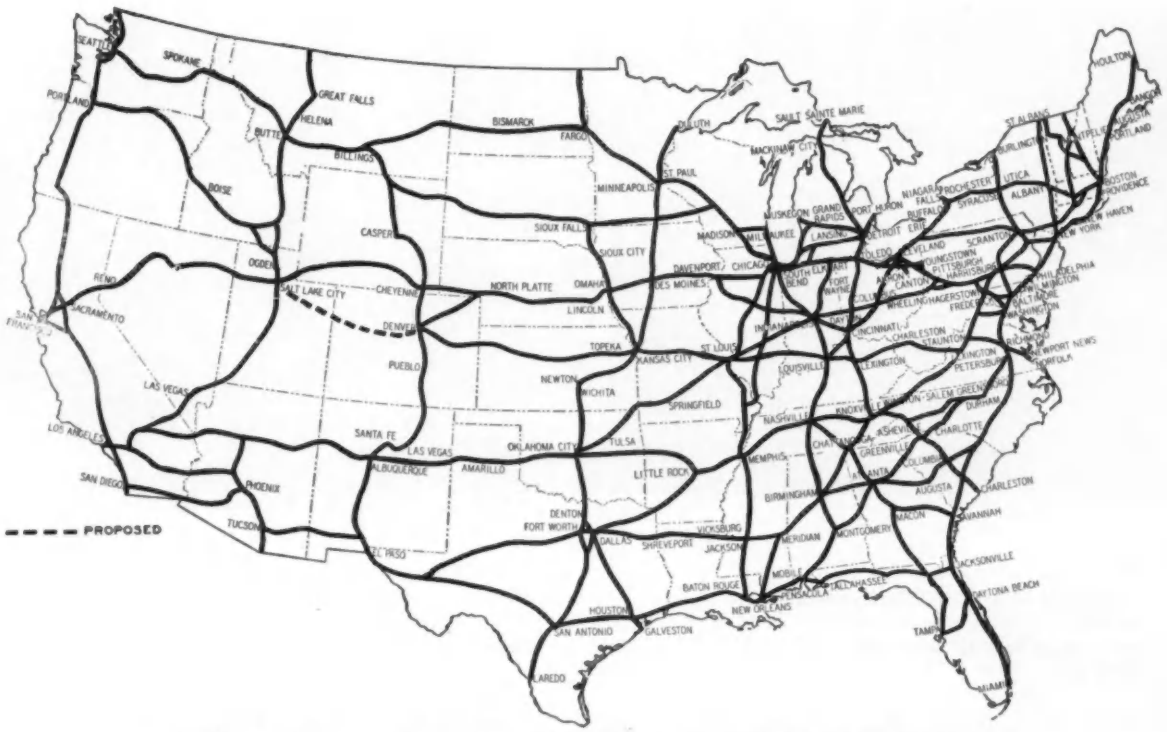
Allowing for variations to meet changes in terrain, a typical stretch of Interstate highway will consist of four or more traffic lanes, each at least 12 ft wide. Median strips 36 ft across will separate opposed lanes of traffic in non-urban areas. All-weather shoulders 10 ft in width will border pavements in all except montainous regions.

Grade separations are to be used to move cross traffic over or under the throughways. Some highway intersections will be permitted in wide-open, lightly-traveled areas, but there are to be no railroad grade crossings.

Bridges and overpasses are to have no superstructures above the safety railings. Overpasses will allow at least 14 ft of vertical clearance above the express routes. Gradings, curves, and sight distances will allow for safe, comfortable driving.

Rights-of-way are going to be wide, measuring up to 300 ft for an eight-lane divided highway with a frontage road on each side. Fixed width requirements are avoided because of price differences and terrain characteristics in various localities.

The frontage roads are essential to the controlled-



FOR THE FUTURE—NATIONAL NETWORK OF MODERN SUPERHIGHWAYS

access plan prevailing for the Interstate highways. Built near these arterial routes, but not infringing on them, will be service, recreation, and comfort facilities within easy access of through traffic. Motorists traveling the new Interstate System will thus be freed from the distractions and hazards of cold drink and barbecue stands and other commercial enterprises that clutter and encroach on the rights-of-way of many present highways.

Every means that engineering skill can provide will be utilized to afford travelers on the Interstate System the ease of unimpeded travel for hundreds of miles at a stretch. Prominent among these means is to be the calculated avoidance of restricted maneuver space in metropolitan centers.

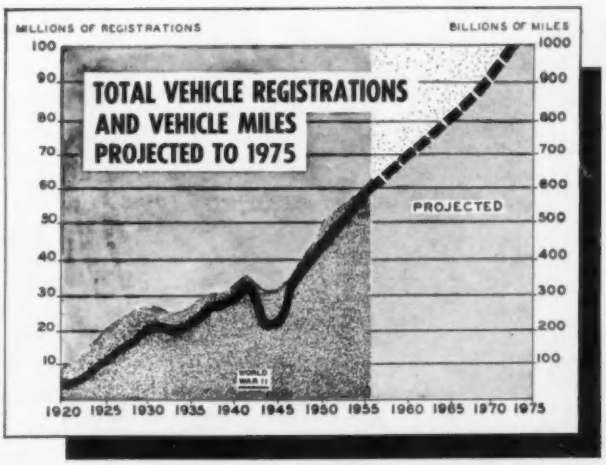
In laying out the general pattern of the 41,000-mile chain of national express routes, the planners have steered away from the heavily built-up industrial and residential cores of the cities. Belt lines and bypasses are to allow through traffic on the new system to remain free of urban bottlenecks. Those drivers with destinations downtown will be able to reach them via access thoroughfares, but there is to be no dumping of Interstate traffic in front of City Hall.

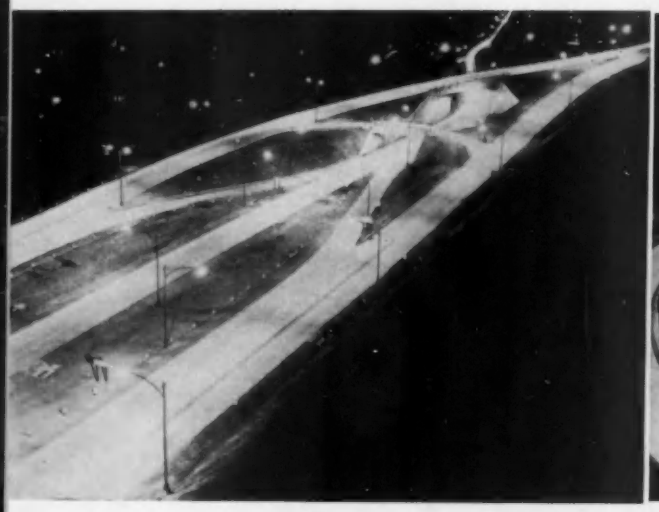
INGREDIENTS OF THE HIGHWAYS

Consumption of the materials that will be converted into completed highways in the next 13 years will be in mammoth quantities. The demand for steel; cement and bituminous material for hard surfacing; aggregates; piling; pipe; explosives, etc.; will multiply swiftly, though not beyond the expected capacities of the industries which will supply them.

Statistics on the usage of these materials as reported by contractors on roadbuilding projects where Federal funds were spent, formed the basis for estimates by the Bureau of Public Roads of requirements through 1969. The following item-by-item forecasts apply to construction of all types of highways for public travel:

STEEL—Well over 3 million tons of steel will be





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MODERN LIGHTING ON HIGHWAYS
as illustrated in above photos will expedite flow of traffic at night

needed annually for roads, bridges, and viaducts, making the total for the next 13 years nearly 49 million tons. Structural, reinforcing (bar and wire), and miscellaneous steel and corrugated metal pipe are included. Not taken into account are the substantial tonnages to be used by the industries which will supply earthmoving and construction equipment.

CEMENT—Demand for cement will exceed 100 million bbl a year by 1958 and rise to a peak of 113 million bbl in each of the years 1964 and 1965. Requirements will diminish only slightly thereafter, and the total for 1957-1969 will be 1.4 billion bbl.

BITUMINOUS MATERIAL—Probable requirement for asphalt, naturalized asphalts, and tar for building and adding to highways this year is less than eight million tons. By 1960, 10 million tons annually will go into roadway projects; and for all the years covered by current forecasts, demand is to exceed 127 million tons.

Aerial View of Pulaski Skyway and New Jersey Turnpike In Newark-New York Area

AGGREGATES—Producers of sand, gravel, crushed stone, and slag are preparing for an increase of more than 40 per cent per year in the tonnages taken by contractors for base and surface work and for shoulder construction. Peak year for utilization of these items is to be 1963, when 775 million tons will be poured into the thoroughfares. Full quantity required for 1957-1969 is to be over 9 billion tons.

LUMBER AND TIMBER PILING—In 1956, approximately 400 million board ft of lumber and 120 million board ft of timber piling are being put into road operations. The requirement, by 1962, is to be 574 million board ft of lumber and 170 million of board ft of piling. Beginning in 1957 and extending through 1969, more than 9 billion board ft of these materials will be headed for the highway construction market.

NON-METALLIC PIPE—Contractors will add nearly 1 million tons a year, by 1960, to the 2.9 million tons of concrete culvert pipe they are laying under roads this year. Demand for clay pipe and tile is to in-

COMPLEX HIGHWAY SYSTEMS
as shown in photos below will be necessary in industrial areas

▼

Three-Level Crossing on New York Thruway outside Buffalo

▲

TYPICAL EXPRESS BY-PASSES AROUND AND FREEWAYS THROUGH CITIES . . . *planned to connect with National Highway System*

crease from 55,000 tons to almost 80,000. It is expected that over the course of the $33 billion program, 48 million tons of concrete pipe and 983,000 tons of clay pipe and tile will be required.

MISCELLANEOUS PRODUCTS—Arrangements for the many-faceted road modernization task must include provisions for blasting away stubborn rock formations, keeping construction machinery moving, and placing signs to guide traffic. Weight of the explosives of all types that will clear the path for construction is anticipated at 18 billion lb. More than 13 billion gal of gasoline, oil, grease, and other petroleum products are to be consumed. New traffic signs and markers for the Interstate System alone will number more than 26 million.

Manpower Requirements

While bulk materials will play an important role in the performance of road building assignments, the critical factors of human brain and muscle must be organized to convert highway plans into realities. This recruitment of manpower, skilled and unskilled, would be extremely difficult if the U. S. faced a decline, instead of a build-up, in its working force.

For the on-site tasks of constructing the highways and erecting the bridges and overpasses, the national population gain provides a potential of 600,000 more men annually. The increase is ample in view of the expectation that the largest highway employment figure visualized is 443,000 persons in 1959.

Highway contractors now total more than 6000; only about half their productive capabilities were put to work in 1955. Contractors are confident that, as of now, they can take care of $8.8 billion worth of business annually.

More critical is the problem of hiring enough professional engineers to make detailed preparations for efficient construction. Finding the men to fill the jobs that will be waiting may require a different approach to the talent hunt. Streamlining of some engineering practices is being weighed, as is the adop-

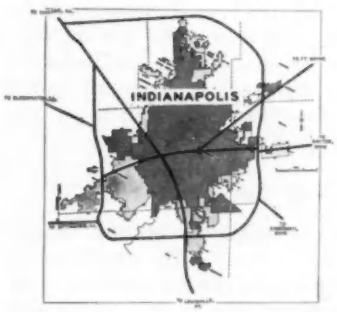
Expanded Highway Program To Use 48,737,000 Tons of Steel

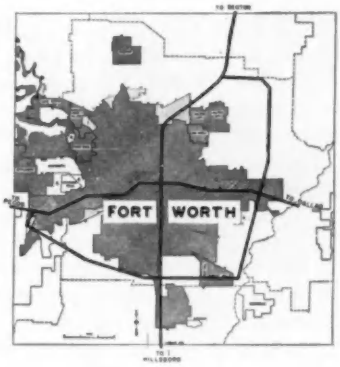
Estimated Material and Labor Requirements for Expanded Highway Construction Program

	1955	1956	1957	1960	1965	1969	Total 1957-1969
Structural Steel, Thousand Tons	983	1,442	1,760	2,052	2,052	1,769	25,737
Reinforcing Steel ①, Thousand Tons	807	931	1,136	1,325	1,325	1,142	16,617
Corrugated Metal Pipe, Thousand Tons	148	165	201	234	234	202	2,938
Other Misc. Steel ②, Thousand Tons	147	182	235	274	275	237	3,445
Total Steel, Thousand Tons	2,085	2,720	3,332	3,885	3,886	3,350	48,737
Cement ③, Million Bbls.	61.6	74.0	94.5	110.5	113.6	97.0	1,399.0
Bituminous Material, Million Tons	5.85	7.15	8.73	10.18	10.18	8.77	127.67
Aggregates ④, Million Tons	403	544	664	774	774	668	9,710
Lumber, Million B. F.	385	403	492	573	574	495	7,194
Timber Piling, Million B. F.	82	119	146	169	170	147	2,128
Concrete Culvert Pipe, Million Tons	2.64	2.89	3.29	3.83	3.83	3.30	48.03
Clay Pipe & Tile, Thousand Tons	47	55	67	78	78	68	983
Petroleum Products ⑤, Million Gals.	652	744	908	1,059	1,059	913	13,280
Explosives, Million Lbs.	90	102	124	144	144	125	1,812
Labor ⑥, Thousand Workers	323	365	424	441	384	302	5,118

① Does not include reinforcement in concrete culvert pipe. ② Includes steel guard rail, fences, cast iron pipe, pavement joint devices, tubular piling, nails, etc. ③ Does not include cement in concrete culvert pipe. ④ Does not include aggregates in concrete culvert pipe. ⑤ Includes gasoline, diesel oil, lubricating oil, grease, etc. ⑥ On-site requirements assuming 1,600 man-hours per year per worker.

SOURCE: U. S. Bureau of Public Roads.





tion of new methods which fit into sound project control practices.

Another aspect of the importance of manpower to the new campaign for top-quality highways is that of wages and salaries for the working force. It is probable that one-third of the money spent in the program will go into payrolls.

Broad Economic Impact

Highway expansion is to contribute a yet-unmeasured impetus to the flourishing American economy in the next 15 to 20 years. Without the stimulus of the huge projects now in the making, the value of all goods and services produced in this country in 1956 should be in excess of $400 billion. A 50 per cent increase in this gross national product (GNP) by 1970 is well within reason, if the rate of annual growth remains unchanged.

Recent experience shows an annual advance of 3 to 4 per cent in the GNP. If it climbs at a rate of 3½ pct, which appears too slow when related to the scope of predictable activity in construction, manu-

NEW YORK THRUWAY NEAR CANAJOHARIE

Contour of land will be changed, streams moved where necessary. This photo shows where engineers moved barge canal to left for New York Thruway.

facturing, and commerce, the GNP will be more than $600 billion a year before 1970. By 1975, when the nation will be working to support some 55 million more people, a gross national product in the neighborhood of $750 billion is possible.

Building highways adequate to meet the transportation needs of this burgeoning economy is to be a generative as well as a consuming process. For each construction job, two other jobs must be started to give backing to the on-site activity. These are to be in a wide range of fields, including transportation, manufacturing, and real estate.

While it is still too early to pinpoint in detail all of the benefits that will result from the new highway program, some of the economies to be derived from better highways can be measured currently. The Interstate System alone is expected to save, in addition to a possible 3500 lives per year, about $725 million in accident damages, $825 million in time which would be lost to commercial vehicle operators, and $550 million in vehicle operating costs. These figures, excluding any reference to reductions foreseen in insurance rates, add up to $2.1 billion a year.

Efficiency of vehicle operation that is made possible by modern express highways is emphasized by C. D. Curtiss, Commissioner of Public Roads. In New York State, he notes, General Electric Co. engineers found that company trucks on round trips between Buffalo and the GE plant at Schenectady averaged more than 10 mph faster on the Thruway than on parallel routes. They also saved 14.2 gal of fuel, made 298 fewer gear shifts, and 69 fewer full stops. Combination of these factors means an appreciable lowering of operating costs for transportation.

New and better highways will unquestionably continue to boost property values, as well as stimulate residential, commercial, and industrial expansion in undeveloped areas. Investment in properties close by expressways is soaring and spreading from New England to California. Before the completion of the New York Thruway, there were by conservative estimate more than $150 million worth of new industrial and commercial facilities erected nearby. In Alameda County, Calif., an area served by the Eastshore Freeway comprises only 9 per cent of the county's industrial acreage, but it accounts for 43 per cent of dollar outlays for new industries and 30 per cent of their total number. More detailed information on how residential and industrial expansion is affected by construction of new highways and the modernization of existing ones will be found in an article of this series devoted specifically to the subject.

Construction of radial arteries, downtown loops, belt routes, and bypasses to good expressway standards under the new highway program, will do much to assist in breaking the current urban traffic jam. Since a large volume of through traffic will be removed from city streets, community business will be benefited. By the same token, easier access to metropolitan centers should stabilize and improve downtown property values and slow down the flight of trade to the suburbs. In many cases, the basic pattern of urban redevelopment will be shaped around new transportation facilities (see article in this series on city transportation).

Future of Toll Roads

Realization that a modernized Interstate System will soon come into being has started a national debate over the fate of the first-line highways of today. In some instances, existing toll and free routes suitable for incorporation into the network will become part of it.

Advocates of and investors in toll highways however, are apprehensive that construction of new Interstate mileage will produce competition that will cut deeply into travel on their routes. The result, they surmise, will be a drop in the value of toll road bonds.

While major toll projects may no longer be developed, there is reassuring word from the Government that the present "pay-and-drive" routes are safe from immediate competition. Louis S. Rothschild, Under Secretary of Commerce for Transportation, tells the toll road investors this:

"The fear of many people that the Interstate System highways will compete with the present toll turnpikes is quite without foundation. There is no intention whatever of building any interstate routes parelleling a toll road which, until 1975, will adequately serve the traffic needs of the area through which it runs."

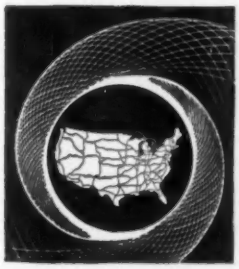
By mid-January, 1958, the Government, in cooperation with state highway departments, is to have ready a report dealing with both toll and free highways built to Interstate System standards and so located as to be suitable for inclusion in that chain. This study is intended as an aid to Congress in deciding whether Federal funds should be allocated to any state to reimburse it for construction brought into the network.

Conclusion

Now that the first preparatory steps have been taken toward creation of a national highway system capable of carrying ever swelling traffic volumes, the driving public will be impatient to test the results. There will be country-wide pressure for the amassing of funds and granting of contracts necessitated in converting blueprint designs into broad ribbons of bituminous and concrete.

To the motorist today, the inadequacies of the traffic routes may appear to be unending. But for the America of tomorrow—the nation that is likely to operate 100 million vehicles by 1975—the new thoroughfares to freedom of travel are on the way.

The New America
That's Coming



NEW HOPE FOR LARGE CITIES

By Samuel Cummings

SOMETHING OUGHT TO BE DONE about urban traffic congestion; to this the American public seems to be agreed. Every year countless editorials and articles are written on the subject of traffic congestion, but still the problem continues to become worse.

Every large city is faced with the same urgent question: how to cope with the great waves of traffic between the downtown areas and the outlying suburbs, a recurring tide that grows larger every year. In every large city, the same picture: long columns of cars, jammed bumper to bumper, flow sluggishly down the main thoroughfares, a confused inextricable mass. Through traffic bound for other cities and trucks the size of freight cars add to the delay and hazard, the fever and congestion.

The price that big cities pay for their failure to solve the transportation problem is enormous, not only in terms of the time and money lost, but also in the damage inflicted on the nervous systems of their inhabitants. The greatest losses occur, of course, right in the heart of the cities, where traffic congestion is at its worst.

The Cause of Congestion

There are just as many views as to the basic causes of the present urban transportation crisis as there are remedies offered for solving it. The most plausible view, however, and one that is shared by most city planning experts, is that most of the traffic ills that plague big cities arise out of the fact that we have attempted to squeeze too many people into too little space. To blame the automobile is to merely confuse

This photograph could have been taken in any large American city during the rush hour. Typical of the U. S. traffic jam, it shows what can happen when we attempt to crowd 58 million vehicles onto roads built to accommodate a fraction of that number. Ten years from now we will have about 80 million vehicles. The question is where to put them. Part of the answer lies in the completion of the 41,000-mile Interstate Highway System in the next 10 years.

Chicago's Congress Street Expressway is a good example of effective city planning. The Expressway is shown going through the U. S. Post Office building (in the background) by way of portals constructed in 1930, ... conceived as far back as 1910 under the so-called Burnham plan.

CHICAGO

DALLAS

The Central Expressway, Dallas, carries more than 40,000 vehicles daily through the heart of the downtown area. The northern section shown here consists of ten concrete lanes, including six freeway lanes and two lanes for service streets on each side of the freeway.

cause and effect. The real cause, it is argued, is to be found in the explosive growth of population that has occurred in the large metropolitan centers in the past 15 years or so; a growth that, taken together with the fantastic increase of automobiles during the same period, threatens to strangle most American cities unless it is checked or scientifically contained.

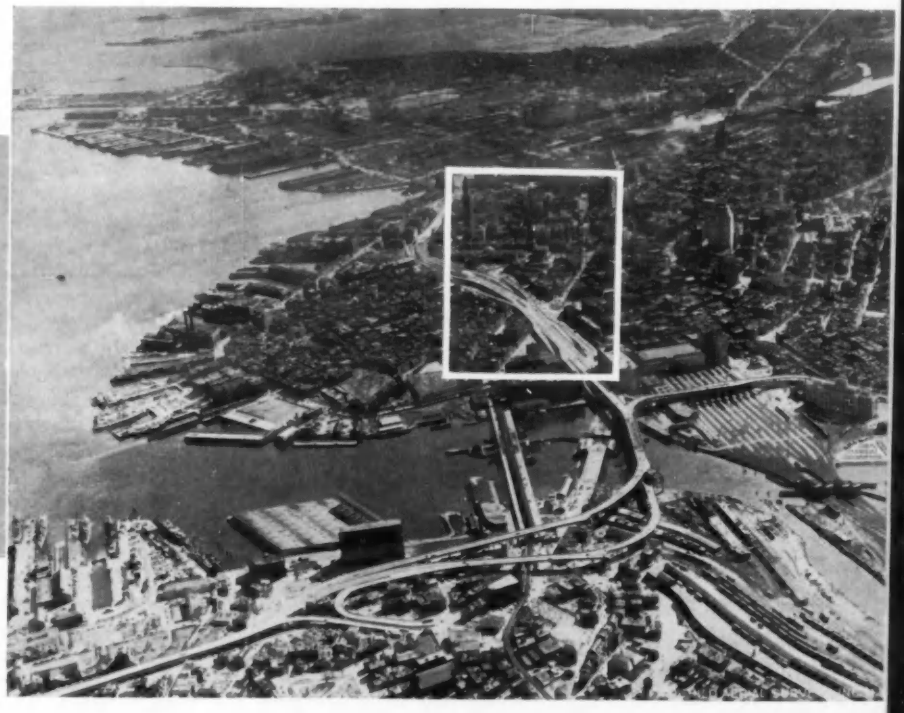
The statistics of national population trends uphold this view. Fifty years ago, three out of every five Americans lived in rural areas; today, according to the U. S. Census of Population, approximately two out of three live in and around large cities. Recent population figures are even more disturbing. From 1950 to 1955, there was an increase of almost 12 million in the nation's population, and about 98 per cent of this gain took place in metropolitan areas. As a result of this growth, urban densities have skyrocketed: in New York City, for example, there are almost 25,000 people per square mile as compared with a national density of 51 persons per square mile. Nearly 60 million people live in the 37 largest metropolitan centers; 60 per cent of the nation's population is crowded onto one per cent of the country's area.

Current population projections offer little hope that there will be any kind of letup in this prodigious expansion. During the next 20 years, experts predict a population increase of over 60 million, and 90 per cent of this increase is expected to take place in the larger metropolitan areas. If this growth occurs, there might be anywhere from 20 to 25 more million people coming to work in our central cities from the suburbs —the bedroom towns—where most of this growth will be felt. The result will be to place an additional load of cars and trucks on city streets already groaning under loads they were never designed to carry.

There is even less comfort for city planners in the statistics of car registrations. There are now over

BOSTON

Boston's Inner Belt Freeway, from the air, shows central artery cutting wide swath through heart of congested downtown district. Note center of picture (white-framed section) is same area as close-up photo, below.



Closeup, below, shows typical section of freeway and ramps. Note width of ramps and extra lane on freeway to permit weaving and merging where on and off ramps are closely spaced.

54 million passenger cars in use in the U.S. Over the next 20 years, it is expected that there will be an increase of almost 30 million cars, or one car to each 2.5 persons as compared with one for each 3.3 in 1955. And, again, most of this increase will take place in urban areas.

In the Los Angeles metropolitan area, which has the highest per capita car ownership in the U.S., this will mean that by 1970 there will be an additional 1.4 million vehicles in use—an increase of over 50 per cent. And if past mileage trends in the area continue, Los Angeles motorists will travel about 43 billion miles in 1970, as compared with an estimated 23 billion vehicle-miles in 1955—a rise of nearly 90 per cent.

FEDERAL HIGHWAY PROGRAM

In spite of the frenzied highway construction of the postwar years, the lag between what our urban roads are and our necessities is still a tremendous one. Although planned expressways are in use in most of our big cities, total mileage figures are not too impressive. It is estimated that there are about 400 miles of controlled access highways in the 25 largest cities in the country, and a little over a hundred miles under construction at the present time.

The new Federal Highway Program, which provides billions of dollars for modernizing the 41,000-mile interstate highway system, should do much to narrow the gap. Although it is national in scope, the pro-

DETROIT

Detroit's 110-mile roadbuilding program consists mostly of depressed expressways with cross streets carried over the main arteries. This view shows completed portion of the John C. Lodge Expressway, looking south from West Grand Boulevard. Note the elaborate multi-level interchange.

gram's greatest impact will be felt on the major population centers that today offer the biggest challenge to roadbuilders and planners. It is estimated that some 6,700 miles of these great new trafficways will be located in urban areas and will be built to full freeway standards.

In the next 15 years about $13 billion will be spent to break the traffic jams in and around big cities. Federal money will pay for 90 per cent of this network, state funds for the remainder. By 1969, when the program ends, motorists will be able to travel over a vast network of high-speed six lane or eight-lane expressways, most of them controlled access highways with no cross traffic. Local traffic seeking to get from one part of the city to another in a hurry will be speeded through downtown areas on freeways that travel overhead or below the street surface. Drivers who want to avoid the centers of cities will be able to travel on inner and outer belt routes that skirt the congested areas.

In most states, plans for the new highway program are already well underway. The reason for this fast start is that most state highway departments had already begun work on their own programs, some of them in anticipation of the new highway aid measure, which most states were confident would eventually get through Congress. In many states, projects to be carried out in the next 13 years under the Federal program will be elaborations of plans made years before.

State programs will emphasize the building of

PITTSBURGH

These before-and-after views of Pittsburgh's Golden Triangle show what a well-planned redevelopment program can do. High-speed expressways and parking garages are an essential part of this vast face-lifting operation which is still in its first stage of development.

PITTSBURGH BEFORE

bypasses, which are also known as belt or circumferential highways, because they take unnecessary traffic away from congested business districts and in some cases function as distributors to funnel traffic onto radial highways leading into the city center. Businessmen who once opposed bitterly these bypasses are now fighting to get them, because experience has shown that bypasses can have a rejuvenating effect on rundown business areas by removing through traffic from congested arterial streets and encouraging shoppers to come into the city once more. But, most experts warn, the bypass should be a controlled access highway, so as to protect it against the mushrooming honkey tonk roadside establishments which would soon succeed in choking traffic movement and thus defeat the purpose of the new roadway.

Right of way planning will be an important part of state highway programs under the Federal bill, since right of way accounts for about 30 per cent of the total cost of all urban highways. Cost of right of way for one single mile of the Los Angeles Harbor Freeway in the downtown area, for example, was $10 million.

One device for insuring right of way while a freeway system is still in the blueprint stage is to set aside a revolving fund for purchase of land while properties are still undeveloped and prices are low, a method that has been used with great success in California. Money from the fund is used to buy up land in the desired location before the appropriation is made for actual construction. When money is then appropriated for the highway, the part included for right of way is returned to the fund for use for other land purchases.

The value of revolving funds as a part of freeway planning has been strikingly demonstrated in California, where such a fund was authorized by the State Legislature in 1952. It is estimated that the state highway commission has saved about $70 million in land purchases since the fund has been in existence, and that another $90 million will be saved by right of way purchases now authorized for $9 million.

Metropolitan Highway Patterns

Although the effects of the Federal Highway program will not be felt for another few years, the regional pattern is already beginning to take shape in some of the larger metropolitan areas. IN THE NEW YORK AREA, the New Jersey Turnpike's 8.2-mile extension between Newark Airport and the Holland Tunnel, built at a cost of $120 million, will provide easier access to and from downtown Manhattan for motorists coming from New Jersey. Drivers will be able to bypass Manhattan on a system of freeways that will cross Long Island and Staten Island and connect with highways to the north and south of the city. A freeway starting near Perth Amboy, about 25 miles south of the Holland Tunnel, will bypass the city on the west and connect up with the New York Thruway around Suffern, N.Y.

Three freeways will speed motorists across New York City. One of these, the Cross Bronx Expressway,

PITTSBURGH AFTER

LOS ANGELES—BEFORE

Los Angeles, looking east from Los Angeles Civic Center, five years ago, before construction of Santa Ana Freeway.

LOS ANGELES—NOW

Same location showing beginning of Santa Ana Freeway as it appears today.

which is nearing completion, will extend from George Washington Bridge to the New England Thruway, via the Merritt Parkway. The Mid-Manhattan Expressway will start at the new Lincoln Tunnel, now under construction, and will connect with the Queen's Midtown Tunnel. A third freeway will cross the downtown area near the tip of Manhattan to connect the Holland Tunnel with the East River Drive.

THE PHILADELPHIA HIGHWAY PROGRAM, although extensive, is still pretty much in the planning stage. Present plans call for an expressway system built around a north-south freeway and an east-west freeway. The north-south freeway will connect up with highways leading to Wilmington, Delaware, on the south, and to Trenton, N. J., on the north. Starting at the Pennsylvania Turnpike Extension, north of Bristol, the highway will travel along the west bank of the Delaware River, passing through the center of Philadelphia, within a few blocks of Independence Hall. The east-west route will follow the bank of the Schuylkill River from the Pennsylvania Turnpike at Valley Forge and provide access to downtown Philadelphia from the west and south. One section will cut across the downtown area to connect with the new Walt Whitman Bridge which will cross the Delaware River to the south of the Camden Bridge.

IN BALTIMORE AN INTEGRATED HIGHWAY SYSTEM is rapidly taking shape. When it is completed, motorists coming from any direction will be able to bypass the city. Now under construction, are a bypass on the southeast outskirts of the city; an outer belt freeway, which will circle the suburbs to the northeast to connect up with main highways north of the city; a north-south freeway, which will cut across the heart of Baltimore from the northwest to the southern outskirts. Plans also call for an east-west freeway which will also cut across the center of the city and connect up with highways to the north.

WASHINGTON PLANS CALL FOR A BYPASS on the southeastern outskirts of the city, an outer belt freeway, an inner belt freeway, and five freeways that will connect the inner and outer belts. The outer belt freeway, which is now under construction, will be located about 10 miles from the center of the city and will enable motorists to bypass Washington from any direction. The inner belt will circle the downtown area; a section of it is now under construction.

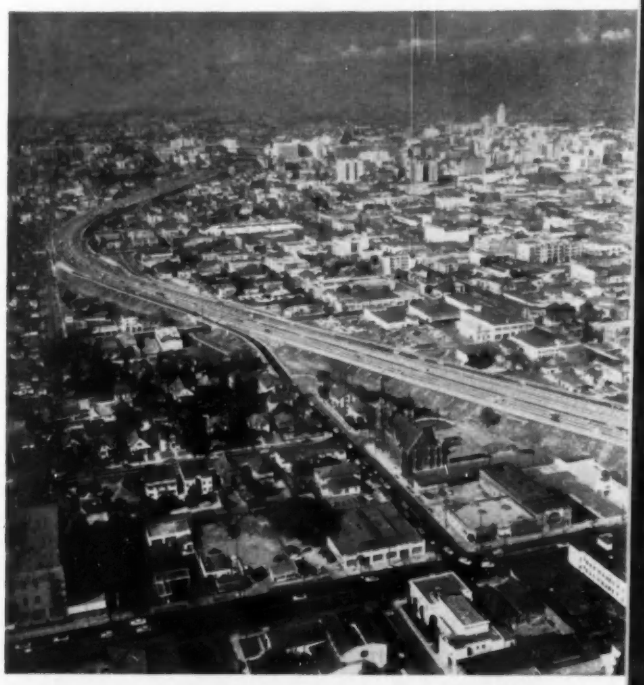
IN BOSTON, THE EXPRESSWAY PROGRAM CALLS for an elaborate 87- mile system of inner and outer belt circumferential highways and connecting radial expressways for the metropolitan area. The inner belt, an elevated expressway, extends from the northern to the southern limits. One section, which cuts its way through the city's narrow crooked streets in the downtown area has been completed at an average cost of over $40 million per mile, giving it the dubious distinction of being the most expensive highway in the world.

THE FACE OF DOWNTOWN PITTSBURGH will be drastically altered when its elaborate system of free-

ways is completed. A 20-mile expressway from the eastern end of the city to a point beyond its western boundary is now under construction. Another freeway will cut across the city to the north, across the Allegheny River, and will join the east-west freeway in the downtown area known as the Golden Triangle. The freeway system, which includes two tunnels, two new double-decked bridges, and a large number of interchanges will provide easy access to the downtown area. It also includes a bypass route for through traffic.

CLEVELAND'S $25 MILLION INNER BELT FREEWAY will speed motorists through the downtown area and will eventually connect up via two radial freeways to an outer belt freeway, which is still in the planning stages. An east-west freeway running close to Lake Erie will give motorists coming from Chicago or New England a fast 24-mile non-stop ride through the city.

DETROIT HAS A MASTER PLAN that calls for an extensive $1 billion, 110-mile system of high-speed expressways that will connect with arterial routes leading from all sections of the city into the downtown business and shopping areas. The highways are being designed so that either electric or gas buses can travel at very low cost and as speedily as automobile traffic.



The Los Angeles Harbor Freeway connects with the Hollywood Freeway on the north through a four-level traffic interchange and runs southerly to the San Pedro district of Los Angeles Harbor. The completed section is now carrying about 160,000 vehicles per day.

Ramps and special turn-arounds are being provided at convenient locations so that depots may be built adjacent to, but separate from, the highway itself.

CHICAGO IS ANOTHER CITY that is experimenting with rapid transit on its expressway system. The city is planning about 70 miles of freeway, at a cost of about $500 million. The eight-lane Congress Expressway, which extends from the loop to the western limits of the city, will include two center lanes for rapid transit trains. Two other freeways will fan out from the center of the city, connecting with main

LOS ANGELES 5 YEARS APART

Although Los Angeles has the most extensive system of freeways in the country, its roadbuilders are finding it difficult to keep pace with the insatiable demands of the automobile. The Hollywood Freeway was originally designed to carry 100,000 vehicles daily; today, five years after it was opened to traffic it is actually carrying over 180,000. These before-and-after views of a section of the freeway shows late afternoon traffic as it was five years ago (above) and as it appears today.

Cleveland—Aerial perspective of Inner Belt Freeway showing the Willow Expressway-Inner Belt Interchange.

routes to the south and east. Another system of freeways will take traffic northward from Gary, Ind., to connect with the Edens Expressway, which leads out of north Chicago in the direction of Milwaukee.

Los Angeles, which already has the most elaborate urban highway system in the world with more than 180 miles of completed expressways and freeways, has plans that call for a total of more than 500 miles. The entire system will cost about $2 billion. Latest addition to the system will be the Golden State Freeway, a north-south route, which runs through midtown Los Angeles from San Fernando to connect with the Santa Ana Freeway. To the west of the Golden State Freeway, another north-south route and an east-west route, which will connect to the present San-Bernardino Freeway, are also part of the new program.

Better City Planning

Although the multi-billion-dollar Federal Highway Program will afford some measure of relief in metropolitan areas, students of the traffic situation are quick to point out that the addition of more miles of road, no matter how ingeniously they are designed, is at best only a partial solution. Highway programs, they contend, do not get to the underlying causes of congestion, an argument that is supported by the fact that the traffic situation continues to get worse despite the most heroic engineering measures to combat it. What good will all these highways do, these critics ask, when as much as 70 per cent of city traffic will still be carried on an obsolete gridiron of streets that was laid out long before the needs of the automobile were foreseen?

Part of the trouble, according to this school of thinkers, results from a confusion of purposes. Streets and highways serve two basic functions which, because they are diametrically opposed, cannot be supplied by the same road: that is, to move traffic swiftly and efficiently through large population centers, and to provide access to business and residential districts. Until these two functions are separated, hard-pressed city planners and roadbuilders will continue to design highways that dump traffic into the center of the city, thus encouraging more motorists to use their cars to get into and out of town, instead of building circumferential controlled access roads that will route traffic around cities and not through them.

The plain fact is, these thinkers say, that the perfect solution to our traffic problems may never be found as long as cities operate on the assumption that they are making progress simply by increasing the capacity of highways systems or by providing more parking facilities for cars that never should have been encouraged to come into the city in the first place. Instead of attempting to squeeze more cars and more people into less and less space, we must face up to the fact that the high-density city has become a

costly anachronism and that the solution to most of our traffic problems depends, not so much on our ability to build better and more expensive highways, as it does to develop urban communities in which effective transportation is once more possible.

What is needed if the city is ever again to provide a reasonable environment for living, these students of the subject contend, and if its traffic is to be reduced to manageable proportions, is the creation of a new metropolitan pattern, in which transportation becomes just another one of the tools of urban planning. Redevelopment of existing urban communities in the direction of greater decentralization will encourage people to live and work in the same areas, thus eliminating a great deal of unnecessary travel, especially during the morning and evening peak hours. Attacking the problem by reducing the demand for transportation facilities, instead of engaging in a futile race to supply the insatiable demands of the man with the automobile, they hold, offers a far sounder approach to a more permanent solution.

Master Planning

What such a program involves is a master plan for each city which seeks to bring about not only a dispersion of population, but a decentralization of economic activity with the ultimate aim of developing separate smaller communities that would function together as a single metropolitan city. Although dispersal planning offers a long-range, relatively slow solution, it is anything but impractical as its critics contend. We are rebuilding our cities anyway; as one advocate of urban redevelopment points out, at the present rate of construction, we will put up enough new buildings in the next 25 years "to rehouse all the people, and all the commercial, industrial and cultural institutions now located in urban and suburban areas."

Bold planning of the kind that is needed if our cities are to meet the requirements of the automobile age is no longer an idealist's pipe dream. A few cities have already made the first steps in this new direction; others will undoubtedly follow, as soon as the success of the first few experiments is demonstrated.

IN PITTSBURGH the most spectacular of the urban redevelopment projects is now taking place on a point of land formed by the junction of the Monongahela and Allegheny Rivers, known as the Golden Triangle. In an area of several hundred acres, which only a few years ago was covered with dingy loft buildings, warehouses, shabby hotels and railroad yards, a neat park has sprung up and seven great office buildings are built. A huge underground garage and high-speed highways that completely encircle the Triangle will take care of the traffic problem. The entire program, which will cost about $1.5 billion, was made possible by the organization of new agencies of government—the Public Parking Authority and the Urban Redevelopment Authority, which include some of Pittsburgh's leading citizens.

CHICAGO HAS A MASTER PLAN that aims to redevelop an area that covers more than 50 square miles and houses more than half of the city's population. Of the total of $1,250 million that will be spent to redevelop this area more than a third will be used for

Another example of effective planning is the Exchange Park development, a privately financed project, which is springing up close to the heart of downtown Dallas. Called the City of Tomorrow, Exchange Park is the nation's first completely integrated and weather-controlled business community.

expressways, motor truck terminals and off-street parking facilities. A 151-acre area in the center of the city, known as the Fort Dearborn project, will contain a 62-acre Government administration center, a 33-acre campus for the University of Illinois, 5000 skyscraper apartments, and off-street parking facilities for 6000 cars.

IN WASHINGTON, PLANS ARE UNDERWAY to redevelop a 1000-acre area in the northwestern part of the city, which contains some of the city's worst slums. About 5000 buildings will be razed, and when the project is completed, there will be new traffic patterns and pedestrian malls. Lower densities and more open space will be emphasized.

Another slum clearance project is planned for the southwestern part of the city, where several hundred acres will be cleared. Part of the plan calls for the new South Mall, which will include modern office buildings, and a cultural and entertainment center.

IN PHILADELPHIA, THE OLD CHINESE WALL has come down and a new redevelopment project known as the Penn Center is rapidly taking shape in the heart of the city, on the site once occupied by the Broad Street Station. The project will include a 20-story office building, a transportation center with airline and bus terminals, and a skyscraper hotel. A sunken pedestrian mall will be lined with shops and have direct connections with the subway system and with parking garages, which will in turn connect with expressways leading out of the city.

IN DALLAS, TEXAS, A SELF-CONTAINED business community known as Exchange Park is now under construction at a cost of about $125 million. Located close to the downtown area, this 120-acre development is circled by major traffic arteries that connect it with the city's principal residential areas; and it is also immediately accessible to every highway entering Dallas from the north, east, and west. When completed, Exchange Park will comprise four large office buildings, representing one-tenth of the available office space in Dallas; a 1000-room hotel with complete recreational facilities; a medical research center, containing professional offices; a maintenance building; a large department store and numerous retail shops. All building units will be connected by air-conditioned pedestrian malls—40-ft-wide walkways covered with overhead skylites. Underground truck tunnels will connect all buildings, providing ample off-street loading and unloading facilities for the largest trailer trucks and leaving the entire area free for pedestrians and for parking traffic. Below-grade double and triple-parking areas adjoining buildings and shops will accommodate 15,000 cars.

Expressways Create Savings in Los Angeles

	Via Expressways	Via Surface Streets
Distance	133.3 miles	123.8 miles
Time	165 minutes	380 minutes
Gasoline Used	6.88 gallons	8.57 gallons
Miles per Gallon	19.38	14.44
Average Speed	48.5 MPH	19.5 MPH
Number of Signalized Intersections	0	578
Average Number of Signals per Mile	0	4.67
Number of Stops Made	0	298
Average Number of Stops per Mile	0	2.41
Operation Cost per Mile:		
(a) Gasoline	1.545¢	2.076¢
(b) Time at 2¢ per Minute	2.476¢	6.139¢
Total Operating Cost	**4.021¢**	**8.215¢**

SOURCE: A 1956 study by the Automobile Club of Southern California covering expressways in the Los Angeles area. Published in "Inside Michigan," January, 1956.

Shape of Things to Come

If city planning meets the challenge posed by the automotive age, what will the city of tomorrow look like?

As the beneficial effects on living environment and property values of the few experiments now being carried out become clearly evident, the pressure towards more and more decentralization will become irresistible. The downtown commercial and industrial sections will become things of the past. The great volcanic eruption of skyscrapers and the unsightly rows of tenements will disappear, and in their place neighborhood units will spring up—pleasant residential areas, made up mostly of medium-sized apartment buildings, located close to modern factories and office buildings, thus eliminating the need for a great deal of commuting.

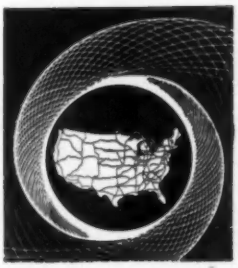
Commercial buildings will be set back from streets so that off-street truck loading facilities will be available. The height of buildings will be limited to reduce the number of people who converge on transportation systems during the rush hours; and the amount of ground they cover will not be allowed to exceed, say, 10 or 20 per cent, leaving sufficient open space for parks, gardens, and other recreational facilities.

Each neighborhood will have its own clearly defined shape and character, with its own cluster of shops, schools, restaurants, and churches, and they will be joined together by modern expressways to form a larger entity—the metropolis. The great tides of traffic instead of crawling slowly through one neighborhood after another will move rapidly along wide arterial streets, and only vehicles with a local destination will penetrate into the neighborhoods through local access streets.

Transportation will no longer be a problem. Most people will be able to walk to work. Pedestrian and vehicle traffic ways will be separated, perhaps on different levels, and walking will once more be safe and pleasant. For local transportation, there will be gasoline or electric buses—faster, smoother, quieter than the ones we have now.

The city would become a pleasant place to work in and to live in: instead of asphalt jungles, the verdant city without suburbs; instead of obsolete street patterns an efficient, well-integrated network of expressways and arterials. In such an environment, the automobile would vastly increase its mobility and therefore become a more valuable part of urban living.

The New America
That's Coming



FUTURE HIGHWAYS TO INCORPORATE "BUILT-IN" SAFETY

Engineering to Provide Free Flow of Traffic and Safer Motoring; Expected to Save 3500 Lives Annually on Interstate System Alone

By Andrew W. Shearer

JUST 57 SHORT YEARS AGO ON THE night of September 13, 1899, the first recorded motor vehicle fatality occurred. H. H. Bliss, a real estate dealer, alighted from a trolley car in New York City and was turning to assist a woman companion when he was struck by an electric cab and mortally injured.

Some 52 years and three months later on Dec. 22, 1951, the millionth motor vehicle traffic death occurred. No one knows just who the victim was or where the accident took place, but the fact remains that we have passed the first millionth murderous milestone and are well on the way toward the second. Incredible though it may sound, the 1,168,075 motor vehicle deaths recorded up to mid-1956 exceed by a sizeable margin the 1,009,750 U. S. military deaths that have occurred in all the wars in American history from the first battle of the Revolution through the Korean conflict.

Urgency of the Problem

Traffic safety has thus become one of the most crucial issues facing the American people. In 1955 alone, for example, 38,300 persons were killed; 1.35 million were injured; and the economic loss ran to some $5 billion.

It is estimated that by 1966 there will be approximately 82 million motor vehicles registered in the U. S., and 90 million drivers will travel an estimated 825 billion miles a year. If the present death rate of 6.4 deaths per 100 million miles of travel continues, 53,000 persons will die in traffic accidents in 1966. Assuming that the percentages hold true, the two millionth traffic victim will be a candidate for a coffin in 1976, if not sooner.

What can be done to halt this blood-letting on the nation's 3.3 million miles of roads and streets? Since nearly everyone is affected by the problem in one way or another, hundreds of opinions have been advanced on how it can be licked. These proposed solutions have ranged all the way from cracking down on the teenagers and getting the drunks off the road to penalizing the slow drivers (as well as the speeders) and building more freeways.

When all is said and done, however, there is no

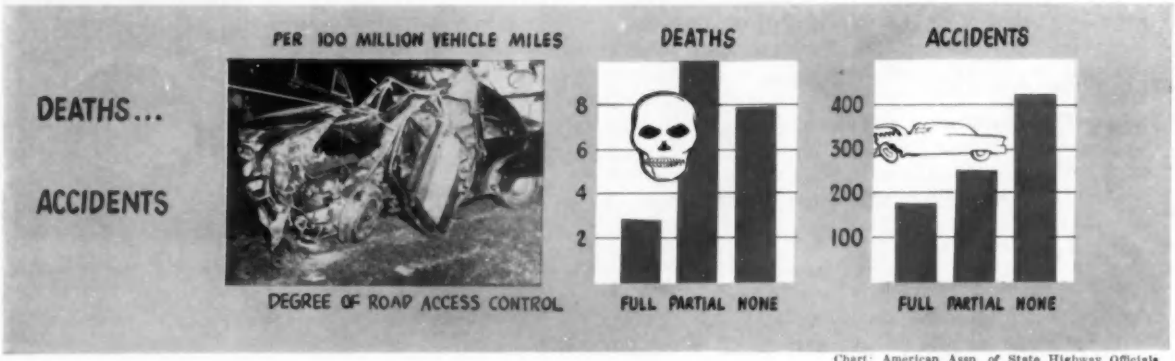


Chart: American Assn. of State Highway Officials
Photo: The Washington Daily News

A HIGH PRICE TO PAY FOR INADEQUATE HIGHWAYS

single, simple solution to the traffic safety problem. Only a well-rounded program emphasizing all phases of traffic accident prevention (accident records, education, engineering, law enforcement, motor vehicle administration, organized public support, public information, etc.) can hope to spell success.

The Engineering Approach

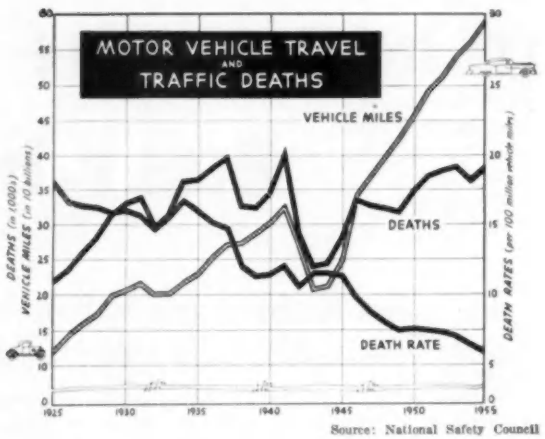
While many other factors must be taken into account also if we are to stop present highway slaughter, there is little question that improvement of the nation's roads and streets, in accordance with modern design standards, will save many thousands of lives. Extensive research reveals that accident rates are considerably higher on poorly designed or outdated roads than they are on adequate ones. The object of this study is two-fold: (1) to pinpoint the deficiencies in highway construction that contribute to accidents; and (2) to indicate how future highways will be designed for traffic safety.

The Interstate System

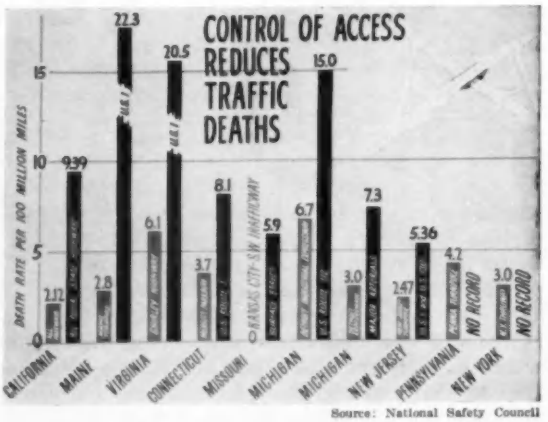
The Highway Act of 1956, in launching the largest program of new road construction and improvement in history, offers an unparalleled opportunity to the highway engineer and the road builder to construct highways that will incorporate a maximum number of safety features. Backbone of the new program is a 41,000-mile Interstate System connecting major centers of population. It is estimated that bringing the Interstate System alone up to adequate standards will save 3500 lives a year.

Although the Interstate System at the present time comprises only 1.2 per cent of total U. S. road mileage, it carries 12 per cent of all urban traffic and 16 per cent of all rural traffic. Losses on this system alone, to traffic accidents, congestion, and vehicle operation are estimated at $2.5 billion annually.

Since less than five per cent of the 41,000 miles is now up to par, the remainder will be rebuilt or constructed new to high engineering standards for comfort, speed, and safety. About 28,000 miles of the Interstate System will be four-lane divided highways; about 7000 miles will be two-lane; and about 5000 miles will be at least six lanes wide. When completed,



Source: National Safety Council

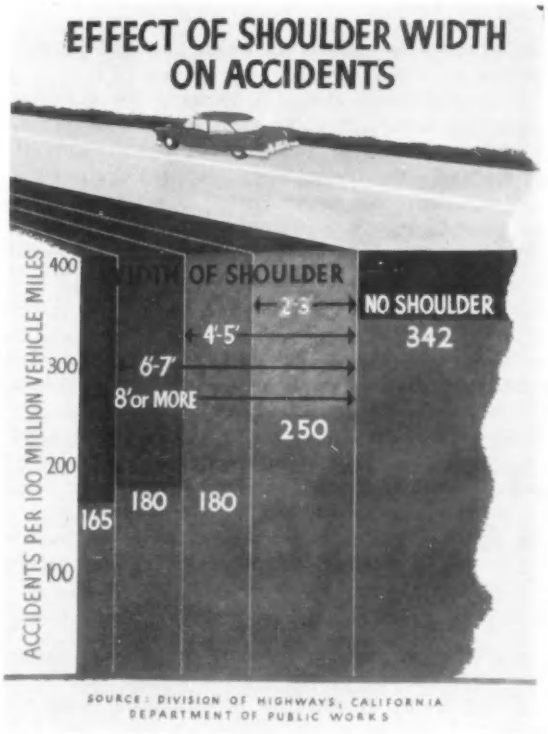


Source: National Safety Council

they will comprise 1.5 per cent of the nation's total road mileage, but will carry up to 35 per cent of the total traffic volume of some 92 million automobiles and trucks by 1971.

Current Road Deficiencies

It has been said that if a 20th century Diogenes set out in search of a good road today, he would take his lantern on a 1500-mile ride for every mile of



modern highway he would find. In short, no less than two thirds of our highways in the U. S. today are below minimum safe driving standards.

The long-suffering motorist has been confronted on every hand by roadway conditions that adversely affect safe vehicle operation to a marked degree. Inadequate control of access, lack of needed median strips and channelization, narrow and poorly constructed shoulders, short sight distances, bad signing, etc., are just a few of the dangerous roadway elements that annoy, confuse, and often help to kill today's motor vehicle operators.

"Building in" Safety

Since roads and streets can be made safer through the application of safety engineering technology, the most practical engineering solution to the accident problem is to build into a highway, within the limit of available funds, all the proved safety features applicable to its type or class. The best time to do this, of course, is during the original construction stage.

Engineers have developed certain principles for highway design, construction, and maintenance that, when applied properly, will promote greater traffic safety. The newly designated 41,000-mile Interstate System, in its role as prime carrier of the heavier and more important traffic movements between practically all cities of 50,000 population or more, must of necessity be built to higher standards of design than those used in the past.

Interstate System Standards

In order to meet the pressing need for "built-in safety" on the new network of Interstate highways, the American Association of State Highway Officials, in cooperation with Bureau of Public Roads, has formulated a set of design and construction standards to be followed in their building. The standards call for the incorporation of all known features of safety to provide safe and relaxed driving, economy of vehicle operation, and pleasing appearance.

The standards adopted deal primarily with principles of what is called "geometric" highway design. Basically concerned with the visible dimensions of a roadway, it is dictated (within economic limitations) by the requirements of traffic. It includes the design elements of horizontal and vertical alignment, sight distances, cross section components, lateral and vertical clearances, intersection treatment, control of access, etc.

Control of Access

If there is one predominant feature of highway design and engineering that promotes traffic safety, it is control of access. As the name implies, a controlled-access facility is a highway or street especially designed for through traffic, and over, from, or to which owners or occupants of abutting land or other persons have no right or easement or only a controlled right or easement of access, light, air, or view by reason of the fact that their property abuts upon such controlled access facility or for any other reason.

Why is an effective controlled-access program so vital to highway progress? The answer is simplicity itself—lack of access control can cut the traffic capacity of a highway by one-half and increase the accident rate by as much as five-fold.

Entrances and exits to and from a highway must be controlled. If cars and trucks or other vehicles are allowed to enter the highway promiscuously with no pattern to slow up traffic and limit capacity, horrifying accidents are the inevitable result. Only by the elimination of crossroads, private entrances, traffic lights, and grade crossings insofar as practical can heavy volumes of traffic flow freely.

Numerous studies have been made which show conclusively that good control of access serves to cut down accident rates. For example, the Bureau of Public Roads recently classified a total of 108,000 accidents on about 2100 miles of highways; approximately 2500 fatalities were involved in the total. The gross rates calculated show that where the highways had full control of access, accidents are averaging 171 per hundred million vehicle miles. Where only partial control (some crossings at grade and some private driveways) is provided, the rate is 240 per 100 million vehicle miles. Where no access control is present, generally on roads that were built 20 to 30 years ago, the accident rate is 408 per 100 million vehicle miles.

A similar comparison has been drawn with fatality

rates—the number of persons killed, and not merely the number of accidents per 100 million vehicle miles. On the fully controlled-access type of highway, the death rate is running 2.8 per 100 million vehicle miles, while on highways with partial control and those with no control, the figures are 9.6 and 8.0, respectively.

It is interesting to note that the partial control fatality rate is somewhat higher than either the fully controlled or the no-control average. Conceivably, this paradox is due to the comparative infrequency of accident hazards where only partial control of access is provided. Thus, drivers are not psychologically on guard to adapt themselves readily to dangers that crop up unexpectedly at occasional weak points.

Many other records abound to show that superior safety is a consistent value of the controlled access highway. It is reasonable to assume that only one third of the deaths and about one half of the accidents per 100 million miles of travel will occur on the fully controlled access highway, as compared with the more conventional type. It might even be said that a substantial measure of highway safety could hardly be purchased more cheaply than through the medium of access control.

In order to control access to a highway, however, the state must also control the adjacent property for a sizable depth along the road. If the state seals off the highway completely from private property, it means isolating motorists from private commercial facilities as well. This element gives rise to the thorny problem of how to incorporate modern, safe methods of highway and traffic engineering into the highway system without damaging facilities serving the new arteries.

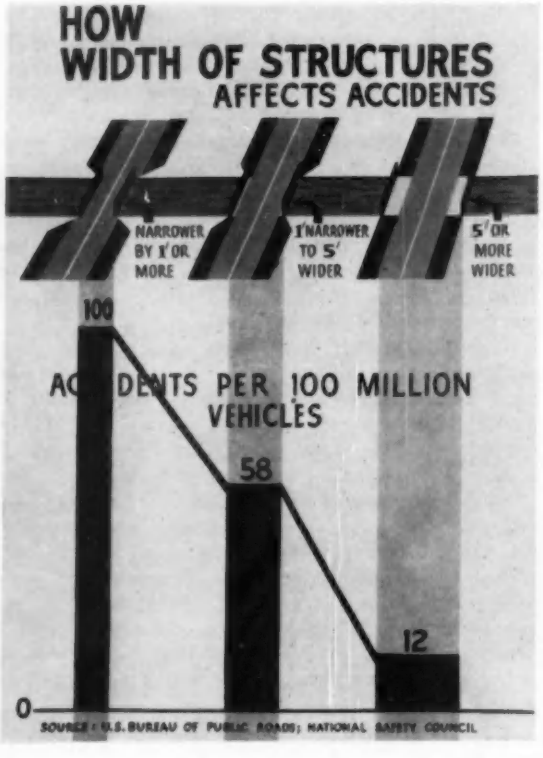
If the modern highway is to serve the motoring public adequately, provision must be made to furnish highway users with restaurants, service stations, motels, and other needed facilities. On the one hand, past experience has shown that it is not feasible for the state to permit encroachment of such facilities directly on the roadside. By the same token, it is not in public interest for government bodies to aid in setting up commercial establishments that would weaken competition.

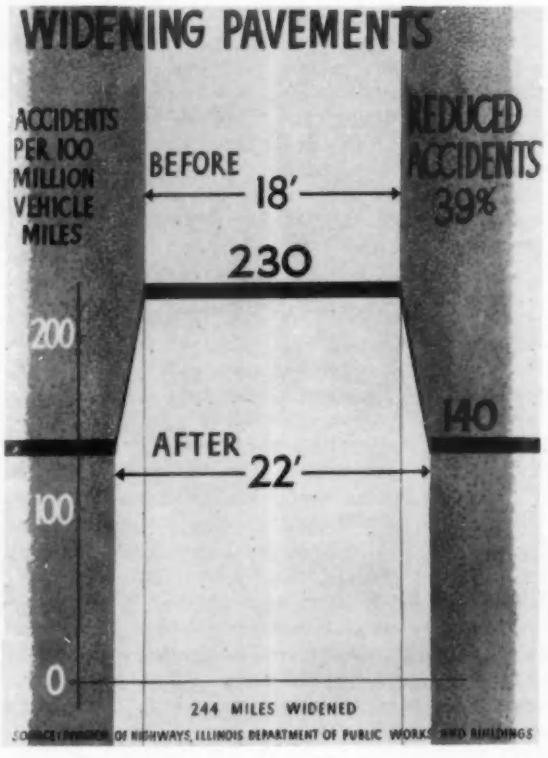
The best solution to the problem appears to have been found in the provision made for the Interstate System in the Highway Bill itself that bars all commercial establishments from the state-owned right-of-way. The motorist will be served by competitive enterprises located on private property along feeder roads or on specially constructed service roads adjoining the highway with entrances and exits planned in such a way that he can leave and enter the highway safely.

Medians

Likewise an important factor in highway design for safety is the provision of a proper median to separate traffic by direction of movement. This element is a particularly advantageous aid to the prevention of head-on collisions.

Medians in rural areas in flat and rolling terrain should be at least 36 ft wide, while those in urban or mountainous sections should measure 16 ft wide





at least. Narrower medians can be employed in such urban areas where right-of-way costs run high, on long and costly bridges, and in particularly rugged hilly terrain, but in no case should a median be less than four ft wide. Curbs or whatever other devices are necessary can be used where applicable to prevent vehicles from crossing the median.

Planned placement of shrubbery in medial areas and allowances for differences in elevation of the two roadways will aid in cutting down headlight glare. Where crossroads occur, the width and length of openings in the area of separation should be sufficient to provide reasonable protection for vehicles that must cross or turn in to or off from the divided highway. Of course, a prime consideration in planning for the new Interstate System will be elimination of all at-grade intersections of public highways and private driveways under the control-of-access principle.

Shoulders

Highway shoulders constitute another item for special concern in highway design for safety. Two of their main functions are to provide an extra margin of roadway for use in a traffic emergency and a logical area to get disabled vehicles off the highway. The usable width of a shoulder should be at least 10 ft so that a simple operation, such as the changing of a tire, may be performed without undue danger.

The effect of wide, firm, and well-paved shoulders in cutting accident rates was graphically demonstrated in a study made in California. The accident rate on roads with no shoulder was 342 per 100 million vehicle miles, but it ran only 165 where shoulders were eight ft or wider.

Width and Number of Lanes

Increases in traffic volume, broader vehicles, and greater operating speeds have compelled more and successively wider traffic lanes. In days gone by, 10 ft was a standard width in many states, but the trend now is to much more liberal widths for principal routes. On this score, traffic lanes on the Interstate System are required to be 12 ft wide at least.

Over 80 per cent of the Interstate System will be four lanes or more wide with broad dividing strips. The remaining one-fifth or so in relatively sparsely settled Western regions will be two lanes wide, at first, but definite provisions will be made for the addition of extra lanes later on.

Sight Distances

Numerous highway accidents occur because drivers do not perceive potential sources of danger until it is too late. Aside from being linked to braking ability of the vehicle, friction characteristics of road and tire surfaces, and driver reaction time, the required length of clear sight distance is inherently linked to travel speed.

It is contemplated that new roads in the new Interstate System will be designed for 70, 60, and 50 mph speeds for flat, rolling, and mountainous topography, respectively, depending upon the type of terrain; design speeds of 50 mph are planned for urban areas. It is imperative, of course, that on two-lane highways sections with adequate sight distances for passing be numerous enough. If this is not possible, a divided highway will be built.

In order to reduce the problem of inadequate sight distances, curves will be slight ones, and gradients will be held to a minimum, except in rare instances where unusually rugged terrain requires a steeper slope.

Bridges and Other Structures

An outstanding feature in the design of the Interstate System will be the elimination of railroad grade crossings for all through traffic lanes. By the same token, bridges and overpasses, preferably of deck-type construction, will be located to fit the overall alignment and profile of the highway.

The clear height of structures will be at least 14 ft over the whole roadway width, including that portion of the shoulder width that is usable. Provision will be made for any planned resurfacing.

The width of all bridges, including grade separation structures measuring 150 ft or less between abutments or end supporting piers, will be equivalent to the entire roadway width on the approaches, including usable width of the shoulders. Comparable standards will influence the requirements for barrier curbs, lateral clearances, safety standards, etc.

Other Factors

Numerous other safety considerations will enter into the design and construction of future highways for safety. A few examples are uniform and properly located traffic signs, signals, and markings; adequate lighting; good maintenance; sufficient drainage facilities; and the incorporation of variances in highway topography.

It should be emphasized here that much research remains to be done in the field of highway engineering for safety. Studies of the relationship between highway factors and accidents have only in relatively recent years begun to receive the attention they warrant. Typical of the basic research needed is data on traffic operation, vehicle characteristics, driver behavior and accident facts, as they relate to varying highway design elements and conditions.

Of course, no implication is intended that the application of the best highway design and engineering techniques and procedures will solve the traffic safety problem; there is no one panacea. However, it may be said with good justification that the causes of accidents center primarily in human behavior and external conditions. If the latter can be improved to the extent that human mistakes and misjudgments are less likely, then the engineering approach can certainly be one effective instrument in the reduction of carnage on the highways.

Highway Operational Control

If our superhighways of tomorrow are to repay their heavy investment in terms of safer, faster, and

The narrow bridge shown in the first illustration was but one of many undesirable and dangerous features of a section of U. S. 50 approximately 12 miles long near Emporia, Kans.; other hazards included bad alignment and narrow traffic lanes. Replacement of the obsolete road with a highway containing such features as the modern bridge structure in the second photo resulted in a substantial reduction in traffic accidents. Note the wide approaches, broad roadway, and sturdy guard rail of the second bridge structure by contrast with the first.

These "before" and "after" photos of a section of Route 22 in Berks County, Pa., show clearly the advantages derived from adding a special climbing lane on the hill in the background. Faster passenger cars are now able to pass slow-moving trucks with safety and ease, whereas previously drivers were forced to slow to a snail's pace behind the lumbering heavy vehicles or fall prey to the temptation to trespass on the opposite lane to get around. Shoulders have also been well paved to provide an extra margin of safety.

Motorists coming upon this bend in the road of an Ohio highway were formerly compelled to negotiate a curve with a very dangerous pitch. State highway engineers were able to correct this hazardous situation with a superelevated structure that helps to counteract the previous bad throw of the curve. The addition of a guard rail was another precautionary measure. Such provision of good sight distances plays an important part in reducing accident rates on highway sections where visibility has been blocked for some distance ahead.

more economical transportation, there must be a sound integration of operational aids with geometric design features at the original blueprint stage. Bluntly stated, the motorist is not paying his tax money for miles of concrete or bituminous roads *per se;* he expects to buy safe, free-flowing traffic movement. The finest highway in the world is useless to him if it is not operated properly to serve his transportation needs to best advantage.

The traffic engineer becomes, then, the inseparable partner of the design engineer in the planning of new highways. Upon his shoulders falls the responsibility for creating the best traffic operation that is possible on roadways as they exist at any given time.

Much to his credit, it is the traffic engineer who has kept inadequate highways operating under difficult circumstances in days gone by. The wealth of factual data he has obtained at times under trying conditions are of inestimable assistance to the planners of tomorrow's highways. His minute knowledge of traffic volumes must be called upon to avoid the tragic errors of underestimating traffic capacities that have been made in the past.

Finally, it must be emphasized that it is the traffic engineer who has been primarily responsible for whatever studies of traffic incidence and safety have been made. It is to his knowledge and skills, then, that we must look for safe and efficient operation of ultra-modern highways of the future.

Regulatory Measures

Since no road or street can be made absolutely foolproof through engineering design, traffic operation still must be controlled to a certain extent through regulation of road usage. Speed control is one element that comes to mind immediately as an important factor from the viewpoint of both safety and mobility.

The Highway Bill of 1956, as mentioned previously, provides realistic limits of 70, 60, and 50 mph for flat, rolling, and mountainous topography, respec-

tively, and suggests that the design speed in urban areas should be at least 50 mph. Although these provisions, like the other geometric design standards in the Highway Bill are said to be minimal requirements, there is also an allowance made for adjustments due to special local conditions. The traffic engineer will, in such cases, be called upon to take such speed control measures as are deemed necessary in the best interests of efficient operation without impairing the basic principle of permitting motorists to proceed toward their destinations at rates of speed consistent with safety.

Unbalanced-flow regulation is another important responsibility of the traffic engineer. During certain hours of peak traffic, there is generally a predominance in the volume of vehicles moving in one direction. This situation arises particularly where there are arterial routes leading to central city areas. Where multi-lane facilities are available, as there will be on the Interstate System, it is often expedient to allot a greater portion of the total roadway width to the dominant traffic movement. Of course, good police supervision and proper directional indicators are necessary for such a system to work efficiently and safely.

Routing of classes of traffic is a third traffic engineering function that promotes sound and safe highway operation. It is especially essential on high-speed thoroughfares that slow-moving heavy vehicles be kept to the right to decrease congestion and increase road capacity. Designation of additional lanes for heavy vehicles on ascending grades often proves helpful also.

By the same token, proper application of the principles of channelization will serve to promote safe and orderly traffic movement. By means of islands, divisional curbings, or other measures, opposing movements of vehicles may be separated, improper or dangerous movements may be thwarted, and correct movements may be restricted to definite courses that are both natural and safe for the driver.

Other regulatory measures, such as turning restrictions, designation of stop and through streets, establishment of one-way streets, parking restrictions, provision of pedestrian aids, roadside control, etc., may, when intelligently applied to trouble spots, yield a worthwhile return in traffic mobility and safety. It should be recognized, however, that no restrictive regulations can be adequate substitutes for such constructive steps as added traffic lanes, grade separations, elimination of bottlenecks, etc.

Highway Lighting

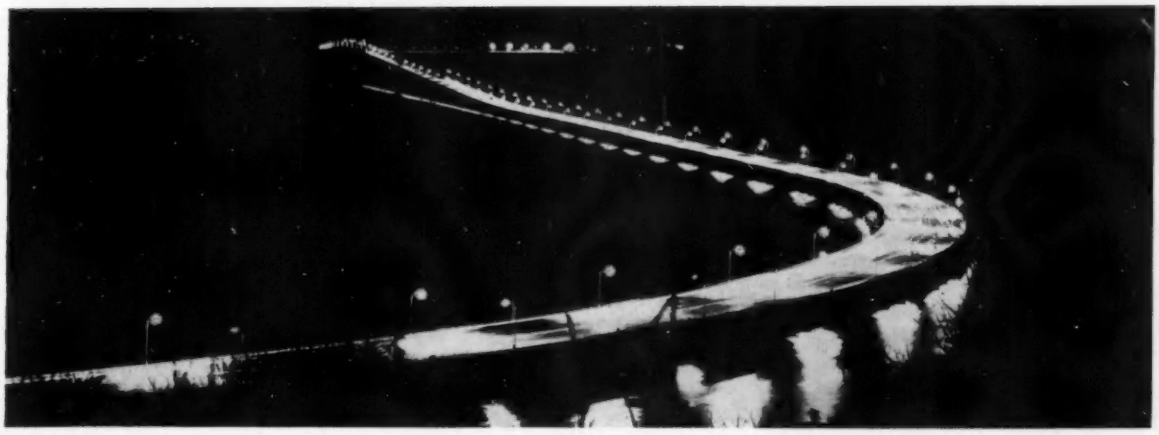
When night closes in on the highways, the scythe of the Grim Reaper flails more furiously. Statistics have been compiled to show that the night mileage death rate for the U. S. as a whole is three times the day rate.

Thus, it is apparent that the provision of conditions which permit quick and clear vision during the hours of darkness as well as daylight is vital to traffic safety. Experience proves that modern highway lighting not only aids traffic flow and cuts accident rates, but it also encourages more night use of the roadway system.

The majority of serious night accidents occur on a relatively small percentage of city street mileage and an even smaller proportion of highway mileage outside urban areas. Primary danger points seem to be: approaches to urban areas; thoroughfares running through towns and built-up sections between them; suburban business districts; congested residential areas; and such hazardous highway locations as curves, traffic circles, islands, intersections, bridges, railway grade crossings, etc.

An interesting example of good modern highway lighting is found on the Ohio Turnpike. Interchanges, toll plazas, and entrances and exits for restaurant

This white serpentine coil of light shaped like an S for safety is the Tappan Zee Bridge of the New York State Thruway at night. More than 250 luminaires make the mammoth span the most concentrated over-the-water lighting installation in the world. The lights are mounted on poles spaced at 125-ft intervals in a staggered arrangement.



service areas are all illuminated by 20,000 lumen mercury lamps. A total of 1323 mercury luminaires are used, 1125 regular and 198 of the color-improved type.

Where conditions point to the need, the cost of adequate highway lighting is easily justified by reduced accident rates, property damages, insurance rates, and an improved environment for night travel. All in all, good lighting is one of the most potent remedies available for night accidents.

Signs and Control Devices

Sufficient empirical data has already been accumulated to underline the point that driving on superhighways can be for many motorists a trying experience. Numerous reports based on individual experience indicate that drivers are often perplexed by the intricacy of interchanges and lack of proper signing.

It must be borne in mind that the motorist who must successfully negotiate such complex structures —whether cloverleaf, diamond, trumpet, direct, or any other forms of the wide variety of interchanges in current usage—is driving on a high-speed facility. Since his decisions must likewise be high-speed, he must have proper signs to provide him with the proper information well in advance. Otherwise, he will be confused every time he wants to get on or off a highway, and such bewilderment is no helpmate of safety.

Nationwide uniformity in the design and location of guide, regulatory, and warning signs, signals, center lines, no-passing zone and other pavement markings, curb and obstruction markings, and other traffic control devices is absolutely essential to minimize confusion and aid safety. The problem becomes more acute now that the Highway Bill of 1956 has been signed because the volume of interstate travel will skyrocket in the years ahead.

The matter of revising existing official standards for traffic control devices and techniques for their use in currently receiving the serious attention of the Institute of Traffic Engineers and other interested groups. We may rest assured that their recommendations, when published, will represent the best engineering thinking in the country on what traffic control devices and techniques will do most to effect free and safe motor vehicle travel flow.

What of the Future?

Driving on the highway of tomorrow should, by and large, be an exhilarating experience for today's harassed motorist. Already in the advanced experimental stage or actual usage are operating devices that hint at greater travel pleasures and safety to come. A decade ago, some of them would have appeared beyond the grasp of the most avid "Buck Rogers" fan.

Automation already occupies a highly regarded place in the arsenal of highway operation weapons. Many traffic departments are using electronic traffic control devices to measure densities of traffic flow and adjust frequencies of signals to keep the heaviest stream of traffic on the move without damming up the lighter stream. Five-point main intersections and expressway exits at "rush hour" are typical areas where this wizardry of electronics has been tried successfully to speed the safe flow of traffic.

Television is making its way out of the living-room and on to the highway to help authorities locate tie-ups quickly. Already used in the Detroit area, we may expect to see even greater usage of this product of the electronic age in the years ahead. It is not inconceivable that in time to come a specially equipped helicopter may be dispatched to the scene of a traffic jam to haul a disabled vehicle off the road as the result of television pictorial report.

Radar is commonly used today for checking on vehicle speeds, and its possibilities for other control devices are almost infinite. Perhaps it will one day be used in vehicles themselves to forestall collisions.

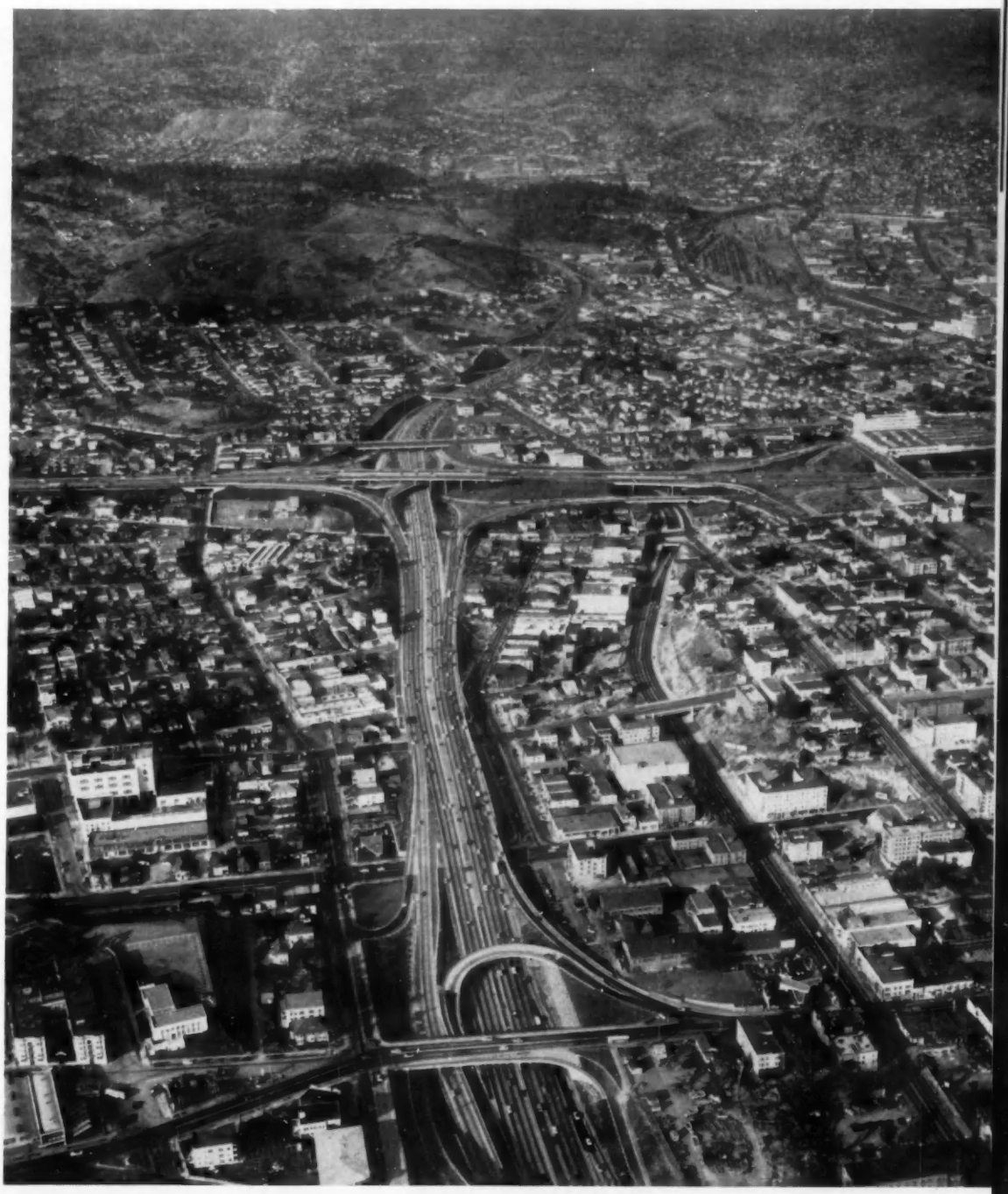
War against dangerous weather conditions will be continued on all fronts. The new Indiana Turnpike, for example, has de-icing equipment built into the roadway at toll plazas. The Pennsylvania Turnpike features "weather sensing" devices which "smell out" bad weather conditions and automatically turn on neon signs to warn of hazardous conditions and reduced speed limits. By the same token, the New Jersey Turnpike has been experimenting with fog dispelling machines electrically powered by Diesel-run generators; a photo-electric cell registers the presence of fog and automatically starts the blades in motion to dispell low-hanging fog.

Just around the corner too is the application of the basic principles of visual perception to highway design and control. This is a brand new and fertile field for experimentation. Mechanical devices alongside the highway, or built into it, will warn the driver of excessive speed, or by "optical illusion" correct his driving errors.

Research work is moving forward in many other fields as well, such as the development of roadbuilding materials that will provide a more skidproof surface for vehicle tires. There are actually no limitations on the opportunities afforded engineering ingenuity in finding practical solutions to the banishment of the traffic jam and the restoration of the phrase "pleasure car" to the American vocabulary.

Conclusion

There can be no question whatsoever that the projected 41,000-mile network of interstate superhighways will bestow on this country benefits of inestimable importance and that its impact on the economic welfare of the nation will be stupendous. In the first flush of enthusiasm at the immediate prospect, however, there is one question that should be



HARBOR FREEWAY, DOWNTOWN LOS ANGELES, LOOKING NORTH

Shown in this striking aerial view, center picture, is a four-level expressway structure, and beyond—the Pasadena Freeway. Hollywood-Santa Ana Freeway is at left and right of the structure. This four-level interchange now handles an estimated 250,000 cars daily, and eliminates the stagnating congestion and accident hazards that formerly prevailed. The free flow of traffic in and out of metropolitan areas made possible by such expressways has a direct beneficial effect in cutting down traffic injuries and deaths.

The Houston Gulf Freeway is one of the longest and safest such expressways in the U. S. today. Frontage roads insulate fast-moving traffic from all cross street and road traffic. Special ramps for entering and leaving the expressway have been provided, so that vehicles can speed safely and easily into this six-lane divided thoroughfare or may exit with a maximum of safety and speed. Concrete median separating the lanes helps to eliminate head-on collisions, while overpass structure in foreground carries traffic safely over railroad and intersecting roads below.

Glimpse into the bright future ahead for U. S. motorists is offered in this artist's drawing of a proposed interchange on a superhighway of tomorrow. The smooth flow of traffic over the grade separations around the loops, and on the straight-aways demonstrates clearly the importance of rigid control of access in preventing collisions. Similar "safety-engineered" miles of concrete planned for the 41,000-mile Interstate System will help connect cities of over 50,000 population into the world's most outstanding network of modern highways.

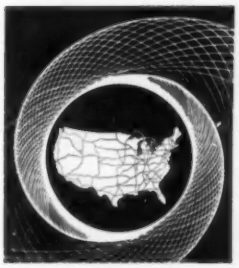
asked on the all-important subject of traffic safety.

Granted that hazards can be eliminated practically entirely from the road of tomorrow, can engineers also develop a superhuman for the superhighway? Since the answer in the light of present knowledge seems to be an unqualified "no," it is essential to plan for super law enforcement as well. Even if it were possible to provide the perfect vehicle for the perfect highway under perfect conditions, the accident potential will still be present simply because the human being in control of this perfect environment is not perfect—and never will be. Only by rigid education in the principles of traffic safety and by the threat of severe punishment for violations can the driver be adjusted to function best within his limitations on the highway.

Motor vehicle operators must be constantly educated to the profound truth of such slogans as: "When you gamble on the highway, you bet your life." If the possibility of sudden death fails to deter them from dangerous acts, and apparently it does not seem to impress some drivers, then these violators must be hit and hit hard where it definitely will hurt—in the pocketbook.

There is no single, easy, or royal road to traffic safety. To repeat, only through a balanced program vigorously supported by the public and embracing all major aspects of the problem—accident records, uniform traffic regulations, education, law enforcement, engineering, motor vehicle administration, and public information—can DEATH ON THE HIGHWAY be given more holidays!

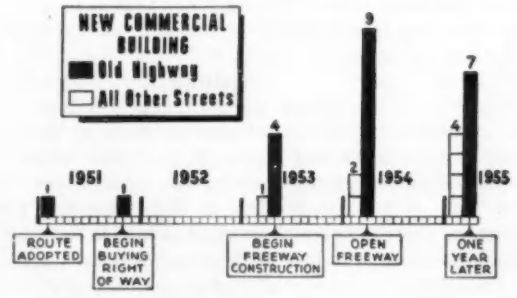
The New America
That's Coming



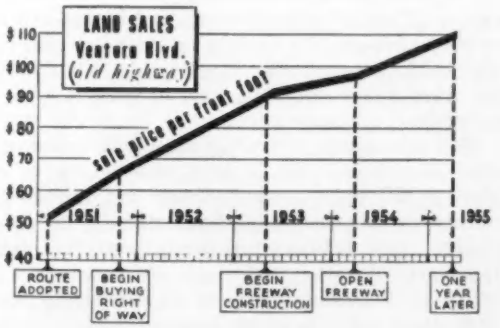
INDUSTRIAL AND BUSINESS EXPANSION *will follow* THE NEW SUPERHIGHWAYS

By Thomas Mac New

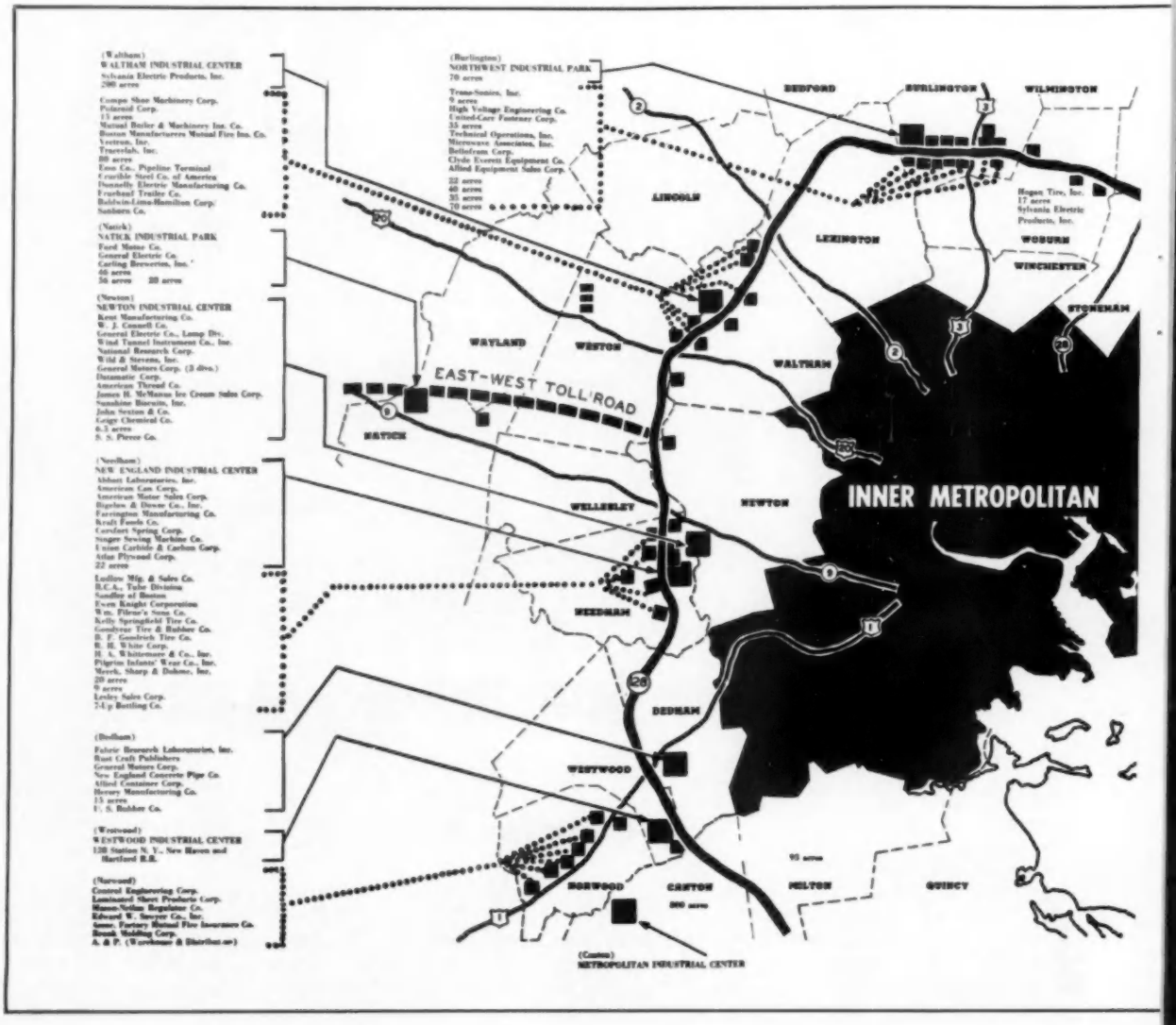
JUST AS A MAGNET DRAWS IRON AND STEEL, the highways of tomorrow will attract business and industry of the future. Wherever new highways are built, industrial plants, service facilities, and residential developments spring up. The economic benefits to business by swift and accessible highway transportation, the ready-made market of motorists to be serviced by filling stations, motels, and restaurants, and the necessity of housing the employes of the new-born plants are readily recognized. Thus, each time another strand is added to the growing network of highways criss-crossing the countryside, another



New commercial building around a typical freeway in California. There were nine new installations the first year the bypass was opened, and seven were underway the next year.



Average sale price for front foot of land on an old highway after a bypass was opened up by the state. Source: California Highways and Public Works.



bulge is added to the sinews of the dynamic industrial economy of America.

The populace of this country has given up two legs, replaced them with four wheels, and has geared itself to the highways. The population shift has been along the good avenues of easy travel. Industry and business too have found that the key to prosperity is the network of highways.

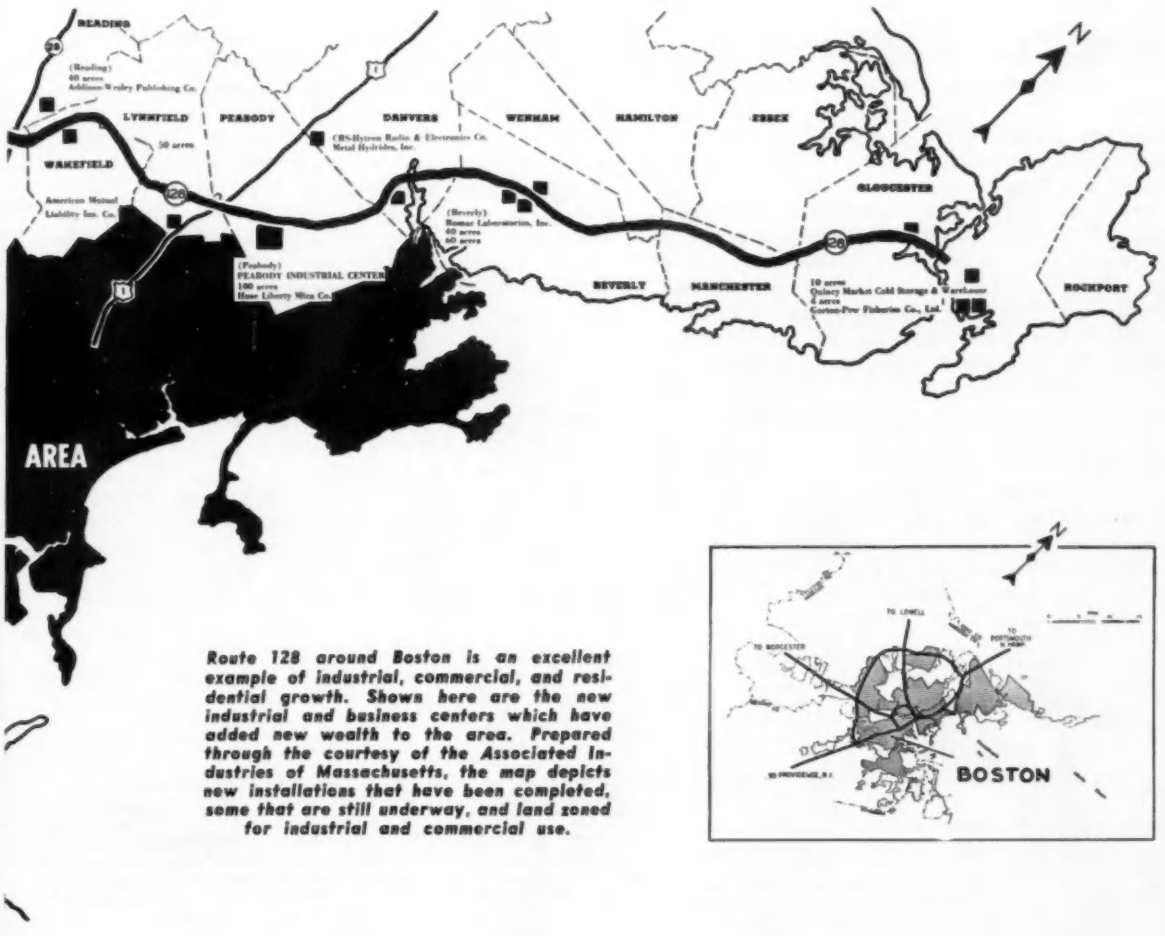
Express highways have become a huge conveyor belt with an endless link of cars and trucks carrying workers and materials to industry and finished goods to commercial enterprises. Approximately 10 per cent of our gross national product is used for highway transport.

WHEN THE PENNSYLVANIA TURNPIKE OPENED in 1940, there were about 150,000 trucks per year using the facility. Today, approximately 3 million trucks roll over the highway yearly. The Turnpike opened new channels of trade, just as this country's new highway program will provide a solid foundation for the national economy in the years ahead.

Example after example of modernization today and its effect on the economy can be considered only a relatively small fraction of what will take place 20 to 30 years from now.

THE FAMOUS "GOLDEN SEMI-CIRCLE," route 128 around Boston, is without question one of America's best examples of industrial and commercial wealth drawn by a vital artery in the highway network. In a span of a few years, the road has brought to the area well over $100 million in the form of new industrial and commercial enterprises as well as huge residential developments. Land values in the vicinity of the highway have rocketed since its inception. New tax revenue from previously undeveloped land has enabled towns to grow with the times and provide better services.

Decentralization and expansion are also the theme



Route 128 around Boston is an excellent example of industrial, commercial, and residential growth. Shown here are the new industrial and business centers which have added new wealth to the area. Prepared through the courtesy of the Associated Industries of Massachusetts, the map depicts new installations that have been completed, some that are still underway, and land zoned for industrial and commercial use.

of business along the NEW YORK THRUWAY. Since the highway has been opened, adjacent areas have been bought up for plant sites, homes, shopping centers, and even branches of banks. More than $200 million worth of new business and private developments have gone up because of the drawing power of the Thruway. The Thruway Authority estimates that 30,000 persons or more will be employed and over $100 million will be paid out annually for wages and salaries because of the expansion that has taken place. This expansion has meant the economic rebirth of whole communities.

New York's Thruway, because of certain extremely difficult engineering problems, was built right through the middle of a small village of some 900 persons. What was thought would bring economic chaos has brought new prosperity. The bonded indebtedness of the village has been retired, new buildings have brought more tax revenue, a new machine tool plant was built, a large dairy was relocated in the village, and a host of new retail establishments have come to the community. This is not one isolated example but just a typical community that has been blessed by the modern ribbons of concrete and steel.

Reports from real estate interests in New York tell of land values that have gone up as much as 1000 per cent along the highway. In Syracuse, almost 600 acres were bought up for a huge industrial site to contain a variety of plants. Altogether, there have been 86 new or enlarged plants built along the Syracuse fringes of the Thruway.

Close to New York City, a $30 million shopping center has gone up; and just across the state line in New Jersey (five miles from the toll road), a $20 million automobile assembly plant has been constructed.

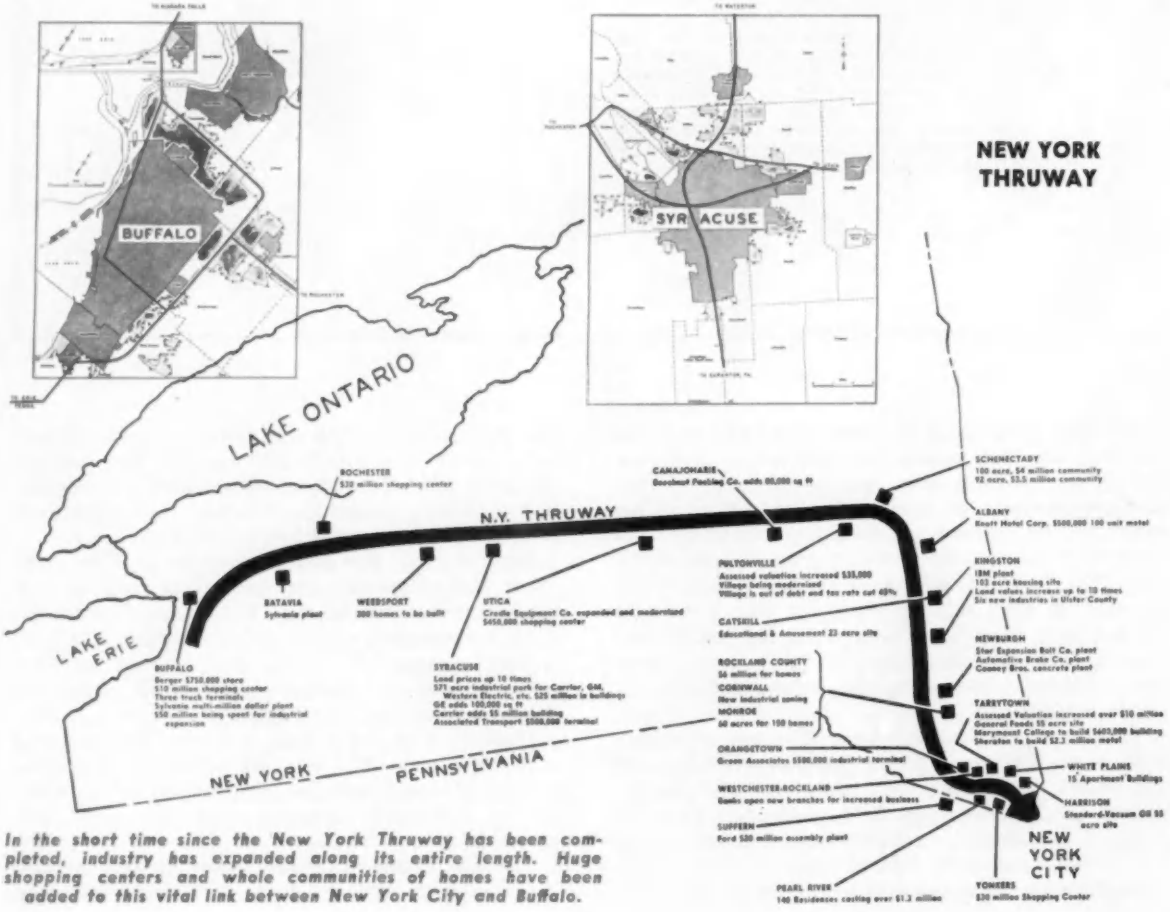
IN OHIO, NEAR THE OHIO TURNPIKE and the proposed north-south link of the New York Thruway,

$60 million will go into a new tractor plant which will employ over 1500 persons. All along the new Ohio road, land values are on the increase, plant sites are being surveyed, service facilities have risen on the countryside, and whole new residential areas are in the works.

DELAWARE VALLEY, U. S. A., which includes Philadelphia and the surrounding counties in Pennsylvania, Delaware, and New Jersey, is an excellent example of growth attributable to highway modernization. Almost half a billion dollars are being spent annually in the Valley for expansion and modernization. Over the next few years, several new industrial plants will be constructed along with huge shopping centers and residential communities because of the excellent transportation facilities in the area. Southern New Jersey, mostly meadows and sand a few years ago, is one of the fastest growing sections in the Valley due to such roads as the New Jersey Turnpike and the Garden State Parkway. One steel firm is expected to put up a $750 million plant within the next five to 10 years, a $160 million apartment project is well underway, and the utilities are spending millions of dollars annually to keep up with the expansion. To the north, another steel company is expanding its three year old plant by 50 per cent; and to the south, a $100 million refinery is going up. Over 200,000 homes have gone up in the area. Only by referring to the accompanying map can one actually visualize the amount of expansion that has come to pass because of "excellent transportation facilities." Estimates on new construction, expansion and modernization in the next 20 to 30 years almost border on the fantastic for the relatively small area. Figures run between $10 and $30 billion exclusive of the new highways which will make Delaware Valley one gigantic city serving the nation and the world. Plans in the Valley include building 637 miles of controlled access roads at a cost of over $1¼ billion in the next 25 years.

IN TEXAS, THE GULF FREEWAY, connecting Houston and Galveston, has been credited with adding 65 per cent to the value of adjacent properties. One section along the Freeway could be bought at 19 cents a foot, but now, since the new road is in, it is worth $1.30 a foot and is still going up.

OUT IN CALIFORNIA, THE FREEWAYS have been a big boon to businessmen. The Freeways have brought shoppers downtown. Merchants, now, would never go back to the old system of heavy trucks and tourists going through the main streets. Small merchants



In the short time since the New York Thruway has been completed, industry has expanded along its entire length. Huge shopping centers and whole communities of homes have been added to this vital link between New York City and Buffalo.

have come to realize that by-passes and controlled access highways have made their local streets available once more to local shoppers. Big business has found that good highways make it practical to move plants into suburban and rural areas. And, workers find that they can get to their jobs more quickly, safely, and easily.

Industry spends millions for new plants, which have to be placed where they can be easily reached by workers and suppliers, and in addition will have ready access to markets. It is only economically sound that industry desires to locate on the vast conveyor belt that lies before us.

A considerable volume of private investments in factories, shops, dwellings and all sorts of service establishments will be stimulated. The impact on retail trade, for instance, will be great. More and more shopping centers will be constructed in areas which are easily accessible to automobiles. Central businesses, which have been increasingly concerned by the trend towards outlying shopping centers, will undoubtedly benefit, too. With better roads, there is no reason why central business facilities served by efficient highways bringing suburbanites to the city and downtown areas should not be able to compete

ORGANIZED INDUSTRIAL DISTRICTS
as Located on Map

1 SPRINGDALE INDUSTRIAL PARK
35 acres—1953

2 AGAWAM INDUSTRIAL DISTRICT
26 acres—1954

3 E. LONGMEADOW INDUSTRIAL PARK
275 acres—1955

4 LOWELL INDUSTRIAL PARK
200 acres—1952

5 "LAWRENCE INDUSTRIAL PARK" SITE
300 acres

6 BURLINGTON INDUSTRIAL PARK
43 acres—1955

7 NORTHWEST INDUSTRIAL PARK
40 acres—1956

8 WAKEFIELD INDUSTRIAL PARK
310 acres—1956

9 PEABODY INDUSTRIAL CENTER
125 acres—1955

10 WESTBORO INDUSTRIAL PARK
207 acres—1955

11 SOUTHBORO INDUSTRIAL PARK
31 acres—1956

12 HOLLISTON INDUSTRIAL PARK
114 acres—1956

13 FRAMINGHAM INDUSTRIAL PARK
178 acres—1956

14 OAK STREET INDUSTRIAL PARK
52 acres—1956

15 NATICK INDUSTRIAL CENTER
63 acres—1955

16 NATICK INDUSTRIAL PARK
32 acres—1950
125 acres—1956

17 U. S. Route #1 INDUSTRIAL PARK

18 WESTWOOD INDUSTRIAL PARK
135 acres—1956

19 NEWTON INDUSTRIAL CENTER
65 acres—1948

20 WALTHAM INDUSTRIAL CENTER
230 acres—1955

21 NEW ENGLAND INDUSTRIAL CENTER
180 acres—1951

22 WEST CAMBRIDGE RESEARCH CENTER
10 acres—1952

23 WESTWOOD COMMERCIAL PARK
11 acres—1956

24 METROPOLITAN INDUSTRIAL PARK
800 acres—1955

25 MILFORD INDUSTRIAL PARK, INC.
26 acres—1955

26 BROCKTON INDUSTRIAL PARK
188 acres—1955

27 BAY STREET
11½ acres—1955

28 AMETY STREET
(near Cook's Pond)
25 acres—1956

29 LINCOLN MILL SITE
18½ acres—1955

30 NEW BEDFORD INDUSTRIAL PARK
800 acres—1956

31 MARLBOROUGH NORTH-BOROUGH INDUSTRIAL PARK
800 acres—1956

32 HILLDALE INDUSTRIAL PARK (HAVERHILL)
50 acres—1956

33 "CHICOPEE INDUSTRIAL PARK" SITE
120 acres—1956

34 AUBURN INDUSTRIAL CENTER
55 acres—1956

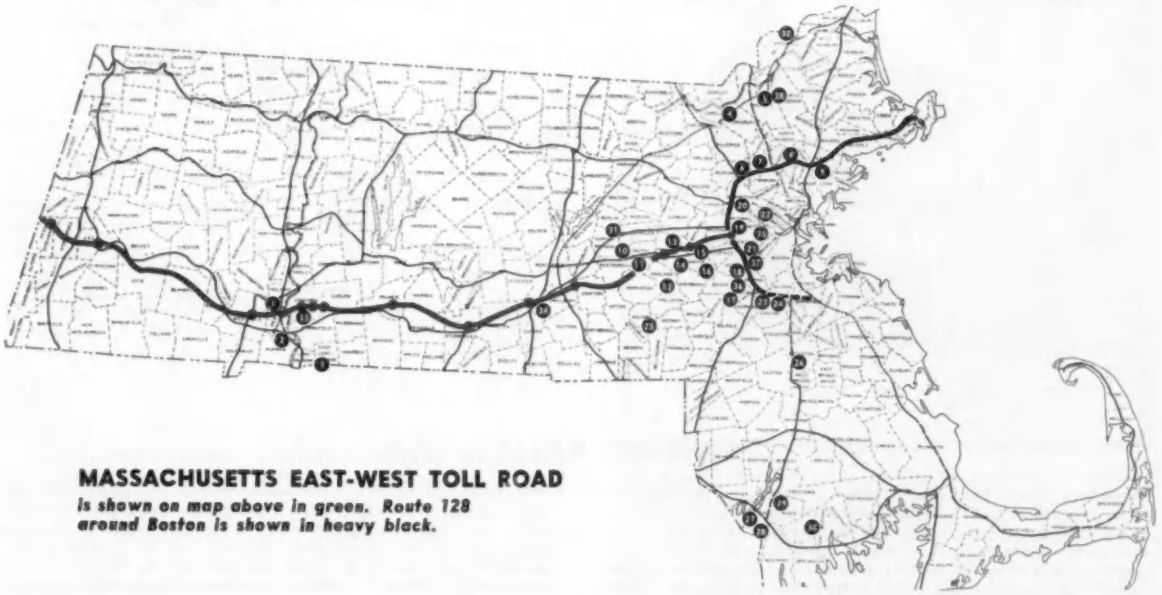
35 BRIGHTON INDUSTRIAL CENTER
28 acres—1956

36 DEDHAM INDUSTRIAL CENTER
28 acres—1956

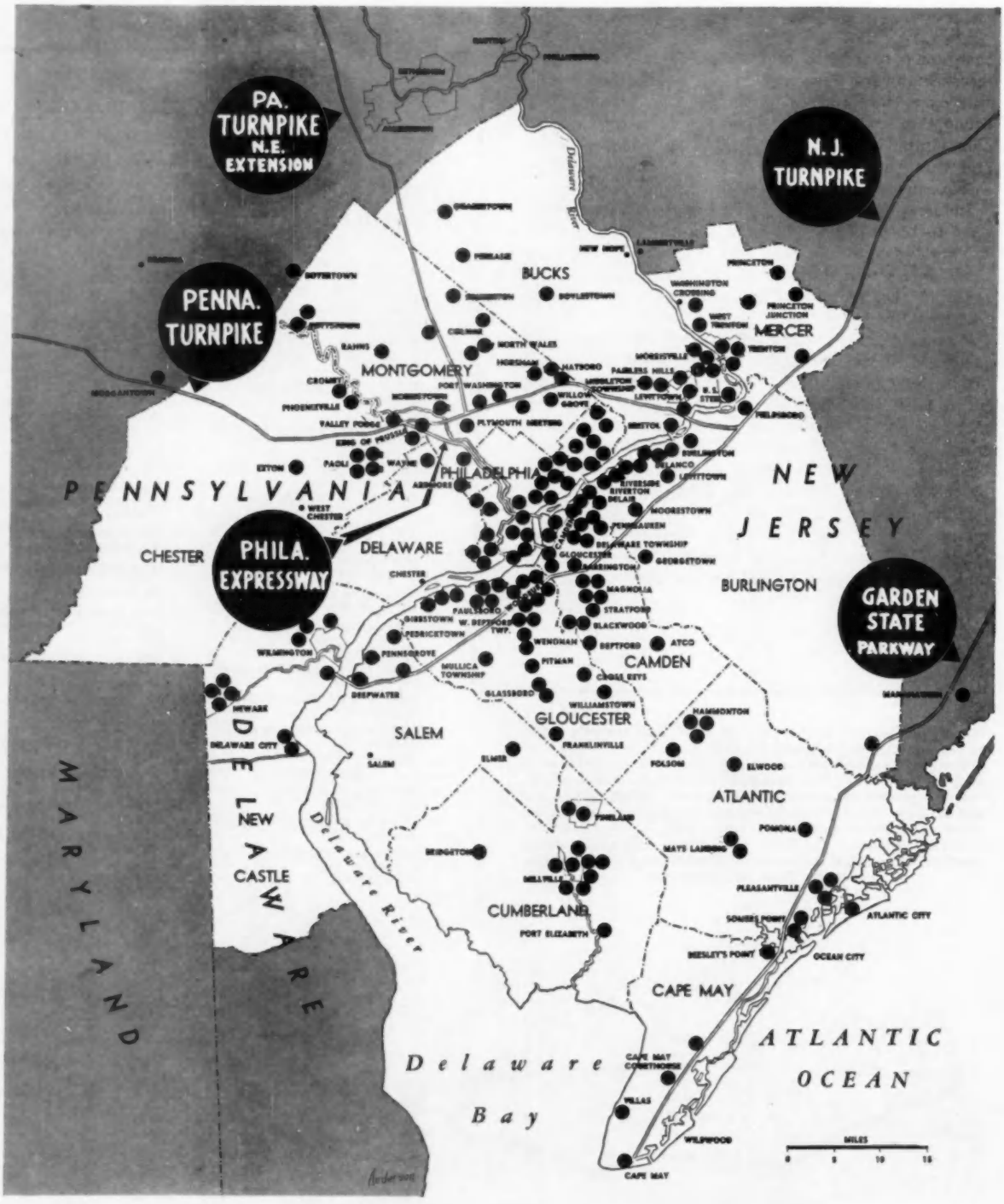
37 ROUTE 128 INDUSTRIAL CENTER
400 acres—1956

38 LAWRENCE INDUSTRIAL CENTER
10 acres—1956

The Massachusetts East-West toll road just recently completed has already brought to that area a new payroll of millions of dollars because of the industrial development which is underway. It is bringing to the state new products and new wealth by providing employment. What will follow will be new communities, new shopping centers, and many other commercial enterprises which will, in effect, create a sound economic condition throughout this state.—Map courtesy Associated Industries of Massachusetts and Massachusetts Dept. of Commerce.

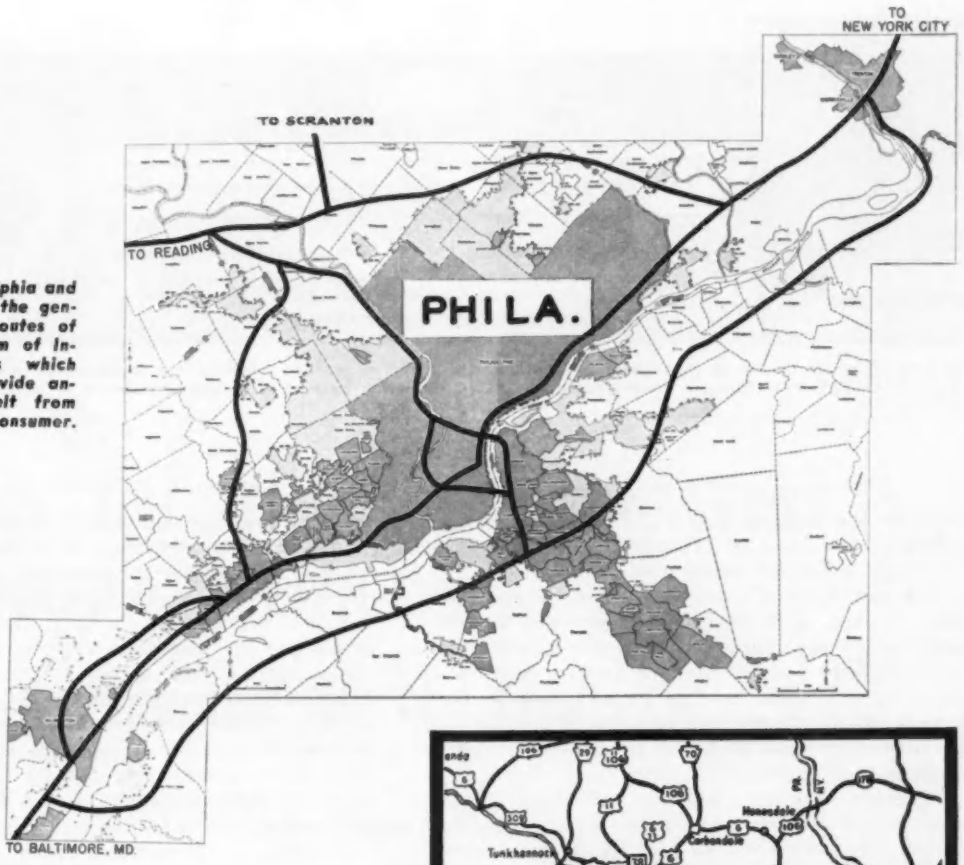


MASSACHUSETTS EAST-WEST TOLL ROAD
is shown on map above in green. Route 128 around Boston is shown in heavy black.



DELAWARE VALLEY, USA

Expansion along the Pennsylvania Turnpike, the Philadelphia Expressway, the New Jersey Turnpike, and Garden State Parkway, has made the Delaware Valley, U. S. A. one of the fastest growing areas in eastern U. S. Each dot shown on the map represents a new plant or project either completed or underway. New residential building has been completed on a scale that would match the population of small towns. Southern New Jersey, an area used principally as a summer resort and for farming is fast becoming a prime industrial area because of its proximity to markets throughout a major portion of the middle eastern United States. —Map courtesy Philadelphia Inquirer



This map of Philadelphia and its environs shows the general locations of routes of the National System of Interstate Highways which will, in effect, provide another conveyor belt from the factory to the consumer.

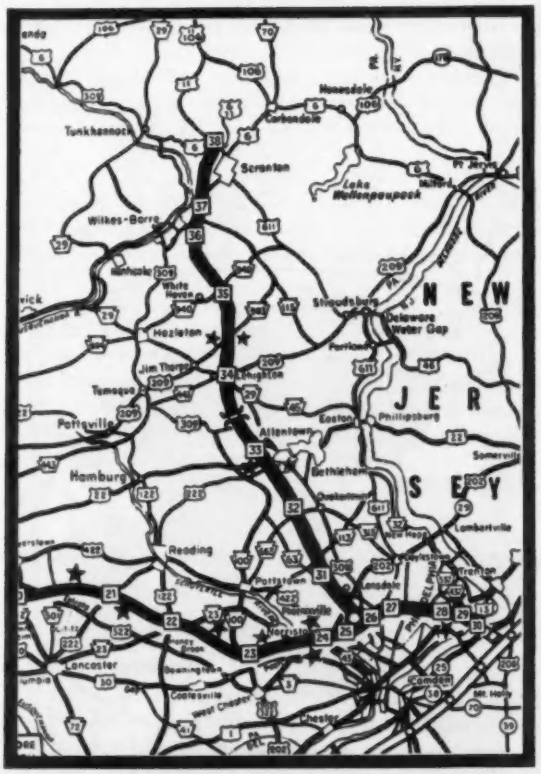
successfully with regional centers on the outskirts.

Of the 2,675,000 unemployed persons in the United States in 1955, 341,000 were from the highway construction field. Many of these would be available for the program. The pool of potential workers from which highway construction industries and contractors can draw is increasing at the rate of 600,000 every year from population gain alone.

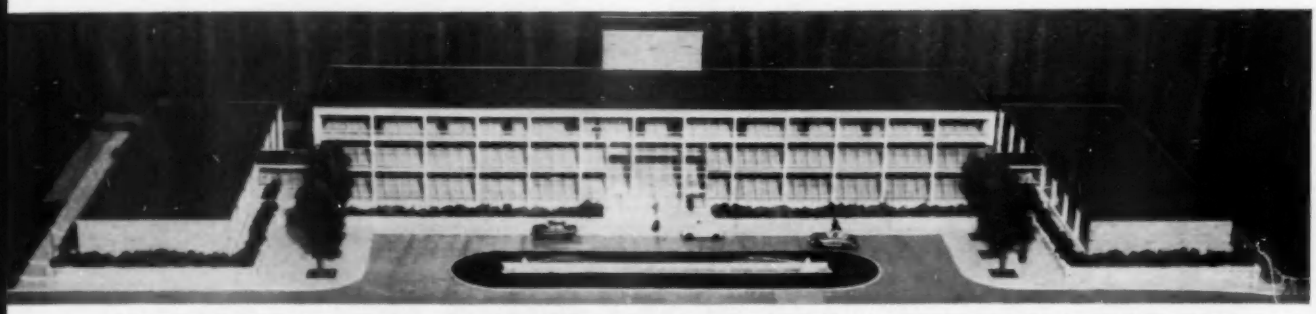
At the peak of its program, the U. S. Bureau of Public Roads estimates a need of 441,000 workers employed 1600 hours a year (seasonal and weather conditions on highway construction are taken into consideration). Roughly twice that many will be needed to supply materials.

An additional important factor to gradual increased Federal spending on highways is that it will enable contractors to spread equipment depreciation which would lead to a stabilization of equipment rates and would promote improvements in equipment use, all of which would result in healthy economies.

In the next 20 years, it is conservatively estimated that there will be 100 million vehicles on the road. These cars, trucks, and buses will travel over a trillion miles per year. This is truly a fantastic market for all business and industry. There will be more and more two-car families and others getting into the three-car-



The North East Extension of the Pennsylvania Turnpike, from Philadelphia to Scranton, will open many new fields of endeavor to those idle in Pennsylvania's coal regions by providing easy access to the area. New markets will be developed, and the country can be further exploited to the already vast number of vacationists who wend their way to the Pocono Mountains.



As new highways spring up throughout the nation, new facilities will be required for maintenance and for the management of the highways. This new Pennsylvania Turnpike Commission building is a typical example of what we can expect in the future.

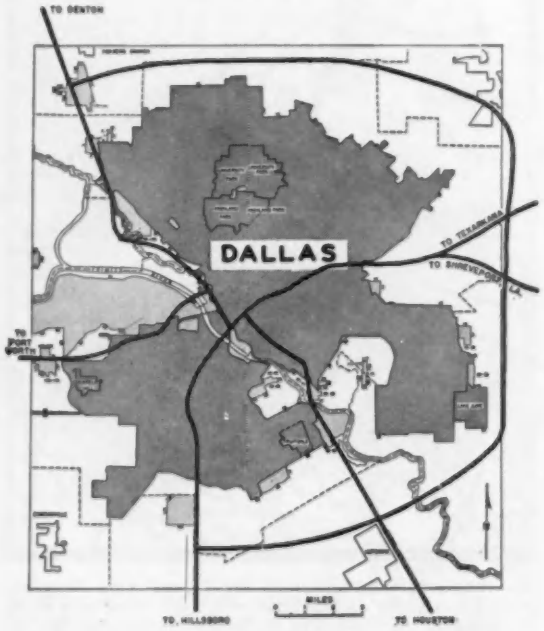
field. As the highways open and with the ensuing industrial and business expansion, vast numbers of trucks and buses will be required.

New machinery will be the order of the day. Productivity has to be increased. There will be more attention given to completely automatic assembly and test machinery for the standard product mass-manufacturing industries. Metalworking companies will have to replace obsolete machines just to keep up with the production race. Machinery producers are already contemplating increased capacity.

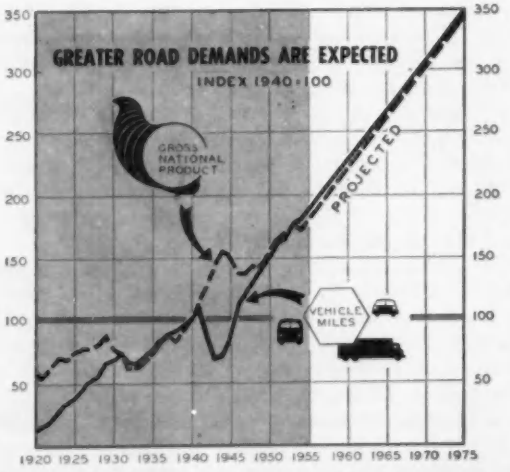
Materials handling equipment will undergo extensive design changes. Automatic warehousing and distribution centers will be built. More attention will be paid to radio communication between mobile equipment whether in the plant or on the highway. New markets will open up for conveyors, industrial trucks, and other materials handling makers.

New motels are opening up in the U. S. at the rate of 4½ per day. Now there are over 60,000 of them in the country. Hotels on the open road appear to be a thing of the past. Only in resorts and metropolitan areas are hotels necessary. Motels are even invading the metropolitan area. Pigeon hole parking will permit them to reach for the sky. Minimum cost of a motel is around $6000 per unit with an average of $7800 for all types and $9000 for the luxury class.

During the forthcoming years extensive decentralization, expansion, and reconstruction will be brought about by the highways of tomorrow. All of industry and business has to prepare itself for the years ahead by upping the production rate and effecting certain economies of operation to compete in the vast market laid at the feet of all industry.

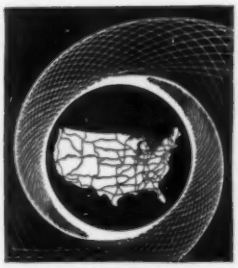


These routes surrounding and penetrating Dallas, Tex., will provide that area with the key to new industrial and residential development.



Gross national product and vehicle miles are shown on this chart. By 1975, both of these will be 3½ times greater than they were in 1940 and more than 1½ times greater than in 1956.

The New America
That's Coming



CONSTRUCTION EQUIPMENT MANUFACTURERS

Prepared for the Challenge

By Kenneth Rose

NOT WITHOUT REASON HAS OUR TIME been called the Machine Age. Just as the factory worker is enabled to produce a better product at a lower cost because he works with costly and complicated tools, so the highways of America are better highways made at steadily lower cost because they are made with power tools. Back-breaking manual labor with pick and shovel, the straining of beasts of burden at heavily loaded vehicles have disappeared from the scene as a significant part of highway construction today. The work is done better, and at lower net cost, by a host of specially designed machines applying the power of, usually, an internal combustion engine.

A question of prime importance, then, in the consideration of any project today, in peace or war, is "Will the necessary machines be available?" As basic as the need for men and materials in the highway program is the need for the proper construction equipment.

How greatly mechanization has affected highway construction is shown by statistics compiled by the industry. During the past 11 years the number of man-hours of labor required to produce a given volume of construction has been reduced 43 per cent. This has resulted in a price level for highway construction practically the same as that during the mid-1920s, while the price index rose about 265 per cent during the same period. Tying the figures to a smaller period of time, it was reported that highway construction in 1955 required only about 52 per cent of the number of employees per billion dollars worth of highway contract as would have been required in 1948.

The amount of equipment required for a project the size of the highway construction program is staggering. Over the 13 years for which construction is being planned, many thousands of vehicles will serve out their useful life and be scrapped, to be replaced by others. Keeping the supply of equipment for such a program at the required level becomes not only a matter of the amount of equipment available, but a matter

1957 ROAD SHOW

Latest designs of highway construction equipment will be exhibited at the 1957 Road Show to be held January 28-February 2 at the Chicago International Amphitheater under the auspices of the American Road Builders' Association. Approximately 250 manufacturers will operate exhibits to dramatize the advances in construction and maintenance machinery.

Construction of the Federal Interstate Highway System started in September near Topeka, Kansas. Dual paving trains are shown here on September 26 placing the first concrete pavement of an eight-mile section of U. S. Route 40, west of Topeka

of the capacity of the industry to produce equipment in the required volume.

A 1956 task force of the American Road Builders' Association, evaluating the ability of the industry to support the program, prepared an inventory of the equipment available for highway contract construction as of the beginning of 1956. This showed the following number of pieces of equipment on hand:

CONSTRUCTION MACHINERY AND ALLIED EQUIPMENT

	No. Units	
Tractors crawler, including attachments	33,000	
Tractors, 2- and 4-wheel, contractor's	9,300	
Scrapers, hauling, all types	17,200	
Off-highway hauling equip., end, side, bottom dump	11,200	
Power cranes and shovels	16,500	
Motor graders	15,100	
Rollers, all types	13,000	
Loaders, front end, wheel	6,500	
Ditchers and trenchers	1,210	
Hydraulic hoists and dump bodies 70,000 (not included in total here but as integral parts of other equip.)		
Air Compressors, portable	13,750	
Batching plants, concrete	4,000	
Concrete mixers, portable	5,200	
Contractor pumps	41,500	
Concrete pavers	1,125	
Concrete spreaders	1,525	
Concrete finishers	1,525	
Truck mixers and agitators	7,300	
Asphalt plants, portable	2,000	
Bituminous pavers (spreaders and finishers)	3,040	
Bituminous distributors, truck mounted	6,800	
Crushing and screening plants, portable	2,300	
Miscellaneous units (10%)	20,928	
		233,703

MOTOR VEHICLES

Pickups and automobiles	11,825	
Trucks, 1½-3 tons	42,350	
Trucks, over 3 tons	38,720	
Trucks, miscellaneous	4,050	
		96,945
		330,648

This equipment has a replacement value of approximately $3.0 billion.

The industry has estimated, on the basis of known ratios adjusted for conditions that will exist, that the replacement value of equipment used on the program should be about 52 per cent of the annual contract value of the highways they produce. Upon this basis the $3.0 billions worth of equipment would be capable of producing about $5.8 billions worth of work on highways. Adding the cost of engineering services and rights-of-way to these construction costs the total value of the highway program that could be supported by the equipment inventory at the beginning of 1956 would be about $7.3 billions. The size and dispersion of most work projects will prevent full utilization of the equipment, however.

More equipment will be required for the program, for replacements and for expansion. It has been estimated that raising the present $5.2 billions of annual highway expenditures to $6.0 billions would require nearly $1.0 billion in new equipment, and to increase this amount of contract expenditures to $8.0 billions would require an additional $1.0 billion in equipment. After the initial equipment expenditures had been made, more than $1.0 billion per year would be required for replacements.

The magnitude of the demands to be made upon the construction equipment manufacturers can be gaged in another way. The average useful life of a piece of construction equipment is estimated as 6.9 years. Contractors find, however, that this figure is too high for their own equipment, and point out that

the overall figure includes highway construction equipment owned by Governmental bodies—national, state, county and municipal—and that such equipment, because of intermittent use and for other reasons, is not subjected to as severe service as that of the private contractor. A useful life of five years is about as much as can be expected, and three years is often more realistic. This means that 10 years of the highway program will consume about two generations of equipment—that is, it will require the equivalent of two complete cycles of all the equipment used, from its arrival from the manufacturer, through its useful life, and to its final scrapping.

The actual requirements in pieces of equipment for $1.0 billion in new highway contract construction per year have been estimated by the task force of American Road Builders' Association, to indicate the levels to which highway construction can be expanded with present capacity in the equipment manufacturing industry. These are requirements for an annual work volume above $5.8 billions. They are:

CONSTRUCTION MACHINERY AND ALLIED EQUIPMENT

	No. Units	
Tractors, crawler, including attachments	4,500	
Tractors, 2- and 4-wheel, contractor's	3,000	
Scrapers, hauling, all types	3,200	
Off-highway hauling equipment, end, side, bottom dump	1,800	
Power cranes and shovels	3,000	
Motor graders	2,500	
Rollers, all types	2,500	
Loaders, front end, wheel	1,600	
Ditchers and trenchers	250	
Hydraulic hoists and dump bodies (not included in total here but as integral parts of other equip.)	16,000	
Air compressors, portable	2,250	
Batching plants, concrete	300	
Concrete mixers, portable	1,200	
Contractor pumps	2,340	
Concrete pavers	150	
Concrete spreaders	175	
Concrete finishers	175	
Truck mixers and agitators	1,500	
Asphalt plants, portable	200	
Bituminous pavers (spreaders and finishers)	300	
Bituminous distributors, truck mounted	250	
Crushing and screening plants, portable	250	
Miscellaneous units (10%)	3,144	
		34,584

MOTOR VEHICLES

Pickups and automobiles	2,600	
Trucks, 1½-3 tons	9,600	
Trucks, over 3 tons	8,500	
Trucks, miscellaneous	1,800	
		22,500
		57,084

This equipment, capable of producing $1.0 billion worth of highway construction per year, should produce $6.9 billions worth of highway construction during its useful life, if it serves for the full average life expectancy of 6.9 years.

With such tremendous quantities of equipment needed, the question that arises in connection with the program is, "Can the construction equipment manufacturers supply the needs of the program, and continue to meet their obligations to the logging industry, the oilfields, and materials handling?" The answer is a definite "Yes."

Leaders in the equipment manufacturing industry

Scraper horsepower has doubled in last 10 years. Modern scrapers (Caterpillars above) travel at speeds up to 32 mph.

Le Tourneau-Westinghouse grader

High speed is attained by this scraper made by Euclid Division of GMC.

Le Tourneau-Westinghouse Model Twin-C pusher

Asphalt paving machines and rollers, operating in tandem, will be a common practice where emphasis is on speed to get a superhighway in service as soon as possible. Here two machines are shown in tandem. Three machines can be used in three-lane construction.

had studied the country's highway needs even before a highway program had been considered by the Federal government, and, recognizing the problem that would confront the nation in the future, had begun preparations to meet it. Part of this preparation was a huge $200,000,000 plant expansion program, substantially completed about the middle of 1956. This increased plant capacity had made it possible for the industry to fill all current demands and still have additional capacity. Most of the industry had operated at from 40 to 60 per cent of capacity during the past several years, and this excess plant capacity now becomes available to meet a peak need.

The year 1955 had seen a substantial increase in the quantity of construction equipment supplied by the manufacturers. Total shipments had risen about 20 per cent over the 1954 totals, and in some lines the increase was tabulated as follows: Hauling scrapers, 25 per cent; motor graders, 16 per cent; rollers, all types, 22 per cent; crawler tractors, 21 per cent; power cranes and shovels, 33 per cent. At this time various parts of the manufacturing industry reported that they were operating at 47 to 90 per cent of peak capacity. This capacity was increased by the expansion program intended to be completed by about the middle of 1956. Increase in productive capacity for such items as wheel tractors, concrete and bituminous paving equipment, and crushing and screening plants was particularly important, as quantities of this equipment threatened to be low for the expanded highway program.

Inasmuch as the program level anticipated for 1956 was $5.7 billions, and the potential of existing equipment at the beginning of 1956 was $7.3 billions of highway program, it seems that there is ample equipment to start the planned construction. During 1956, the construction equipment manufacturers, if they used all facilities to capacity, could produce new equipment capable of producing about $1.5 billions in new construction. Of this, it is estimated that about $1.0 billion of the production could be devoted to highway construction, while the remainder would be required for other industries. Adding $0.2 billion for engineering and right-of-way costs, the added program potential would be about $1.2 billions of gross annual highway construction, making the total potential $8.5 billions by the end of the year.

In addition to this, it has been estimated that the existing manufacturing capacity could support an annual increase of about $0.6 billion in contract construction for a few years. Adding engineering and right-of-way costs, this would be equivalent to $0.75 billion in annual gross program level. On this basis, the program level that could be supported by the equipment manufacturing industry with its present capacity might rise to $9.7 billions by 1958, and to $11.0 billions by 1959.

Plans for the future already made or now being formulated by equipment manufacturers indicate that the industry has no intention of working so close to its peak capacity. Again anticipating future demands by the highway program and by other industries using construction equipment, the industry has planned to increase the work potential of its output. This will be done in several ways.

(1) Plant capacity is already being expanded or expansion is planned for.

a—Domestically. New plants are under construction or being planned, or existing plants are being equipped or enlarged.

b—Abroad. Additional American-owned plants will be built in many parts of the world.

(2) Some existing plant facilities can be switched to production of construction equipment.

(3) New construction equipment has increased work capacity.

a—More power is provided for (1) greater speed, or (2) greater load-carrying capacity.

b—Lighter weight in the vehicle can be converted into increased payload.

(4) Much new equipment has greater mobility. Shovels and cranes that were formerly fixed in location are now frequently self-propelled.

(5) Power is more effectively applied.

Many companies in the industry have planned substantial expansion programs. Just how much the expansion will be is not yet possible to determine, but it includes both the construction of additional plants and the expansion of existing facilities, in this country and abroad. As examples, International Harvester's Construction Equipment Division is planning to utilize about 600,000 sq ft of floor space formerly used for other purposes. There is in prospect an expansion of plant capacity in England also.

Caterpillar has in prospect a new plant at Aurora, Ill., a parts plant for Miami, Fla., and a plant for Glasgow, Scotland. Allis-Chalmers, with a big expansion program completed two years ago, is now completing another, and is beginning plans for still greater expansion. Harnischfeger expects to expand facilities, and is considering both foreign locations and additional plant locations in this country. Koehring Co., which has recently expanded its capacity by purchase of subsidiaries, and has plants in Japan and Australia in addition to its domestic operations, is considering the matter of expansion after existing facilities are operating at capacity. Euclid Division of General Motors has planned a new 580,000 sq ft plant in Hudson, Ohio, for its immediate program.

In some companies, the application of facilities normally used for other production to the manufacture of construction equipment is planned as a means of increasing output when capacity in equipment manufacture is reached. Mack Motors, for example, produces both highway vehicles and off-the-road carriers. When the plant equipment ordinarily used for the latter type becomes overloaded, some of the work can be

COMPARISONS: PAST AND PRESENT

In roadbuilding 50 years ago—for a haul of 500 ft—each rig could move approximately 10 cu yd of earth a day. Contrastwise, middle picture shows Caterpillar tractor and scraper being push loaded by a tractor equipped with bulldozer and push cup. Bottom: Allis Chalmers crawler tractor and scraper push loading a motor scraper.

Steam-powered mixer of long ago —dwarfed by latest equipment. Picture below contrasts present highly mechanized construction methods in laying of slag concrete pavement.

An elevating grader of the 1920's pulled by a tractor—early example of mechanized earthmoving. Picture below contrasts modern loader, pushed by a tractor, putting 15 yd in bottom-dump truck in 25 sec.

routed to machines regularly assigned to production of the former.

The matter of increasing the capacity of construction equipment by improvements in design is an extremely important one. Some of the trends in equipment design have already become well established.

Harnischfeger P&H Model 555 TC truck crane handling concrete for bridge construction.

Rubber tires have become so widely used on wheel tractors and earthmoving equipment as to be practically standard, but they were introduced only shortly before the war. They have been an important factor in increasing vehicle speed. More power is being provided in work vehicles, either for carrying larger loads or for increasing speed, or both. Both have the effect of increasing the amount of material the vehicle can move in a given time. There is a steady trend to larger sizes of equipment, followed constantly as contractors report the larger sizes as moving earth at a lower cost per cu yd. For example, a leading manufacturer of tractors produced a large model of 132 hp that weighed 28,000 lb bare. This model was dropped in 1947 in favor of a larger one, and the present successor is a 204 hp model that weighs 44,000 lb bare. The 3-cu-yd shovel, a specialty a few years ago, is now a standard piece of equipment. Off-highway earthmoving vehicles are rubber-tired giants, one producer offering them in standard sizes of from 10 to 50 tons. Improvement in rear axle design is credited with being an important factor in making the larger sizes practicable. The cruiser crane is a standard self-propelled piece of equipment that is more flexible in use than the stationary crane.

Improvement in design has sparked the advances made so far in construction equipment. The prime power unit has been greatly increased in power output without a corresponding increase in weight. Higher speed engines of lighter weight have been one of the means of achieving this. Another has been the increasing use of the torque converter. Use of the turbocharger is increasing as favorable results are reported.

A shovel of an earlier model weighed 75,000 lb. By redesigning it so that the structure made greater use of weldments, to save structural weight, and bringing the machinery into use as a part of the ballast, the weight of today's unit of equivalent capacity is only 45,000 lb.

Moving in the opposite direction from the cruiser crane, for which power for self-propulsion was added to eliminate the need for a supplementary mover unit, is the motorized scraper. In some designs this is a completely self-contained unit, with the power plant providing the power for the work cycle in which the scoop is loaded, and for the transportation cycle in which the load is moved to the dump site. This is the self-loading type especially successful in the smaller sizes. In the larger sizes, and in some smaller sizes also, there is a trend to the use of supplementary power for the loading cycle. A tractor, pushing against a pusher block on the scraper, provides the extra power needed when the scoop is being filled, and the power plant in the motor scraper is adequate for transporting the load to the dump site.

Power steering for construction vehicles is adding to operator comfort on the job, and making possible the use of larger vehicles over rough terrain. Tubeless tires, developed for passenger cars, have been produced for the heavy construction trucks recently, and seem to be moving toward wider use.

The ripper, a toothed blade for breaking up hard soil before scooping it up, seems to be on the way to becoming an integral part of the tractor with bulldozer blade. Formerly it was the practice to run a ripper over the ground to loosen it, and then to cut it down with the bulldozer blade. The ripper was sometimes moved over the ground by a separate vehicle, or was sometimes mounted on the tractor instead of the bulldozer blade, being replaced when the ripping had been completed. Present favored design provides for mounting the ripper blade just behind the bulldozer blade, with provision for raising and lowering each independently of the other. The bulldozer blade is raised and the ripper blade lowered for the ripping run over the ground, and the position of the blades is then reversed and the loosened earth is 'dozed down.

An electronic leveller, recently announced, is being installed on some motor scrapers to control the position of the blade very accurately. It is claimed that it maintains the desired position within ⅛ in., the electronic device making automatic adjustments as the blade tends to move out of position when in use.

What of the future in construction equipment? Leaders in the industry agree that there must be even

greater mechanization of the processes if construction prices are to be held down in the face of rising costs of labor and materials. They foresee a continuing improvement and refinement of present types of equipment, however, rather than the development of any radically new types. The basic operations in earth-moving are those of the pick, to loosen the ground, and the shovel, to scoop up the loosened earth, followed by its transportation from the work area. The progress that has been made so far is in the mechanization of these operations. The mixing and application of paving materials have been similarly mechanized. Mixing of concrete for supplementary structures, such as culverts and bridges, and transportation to the work site have followed the same lines. Size and power of the machines used will increase as rapidly as contractors find larger sizes economical.

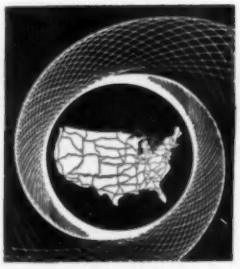
Speed is a consideration not ordinarily thought of in connection with highway construction by the man in the street. It is extremely important to the contractor, though. Most construction contracts are penalty contracts with a time limit, and perhaps with a bonus provision for finishing ahead of time. Increase in horsepower can be translated into increased speed or increased load-carrying capacity, or both, and light weight can be similarly used. There is a strong trend toward faster operating vehicles for the future.

Lighter weight without decrease of strength is a line of improvement that has already paid off well. Use of the alloy steels to obtain greater strength and greater resistance to corrosion has begun, and promises to be extended rapidly in the future. Aluminum bodies for off-highway vehicles are under test. The use of nodular iron castings for greater strength and lighter weight has begun, and reports are favorable. There seems to be an opportunity for greater use of belt conveyors for conveying materials, such as aggregate for concrete, to the mixers, and for conveying the mixed materials to the work site. Use of belt or bucket conveyors for removing earth will probably be expanded also.

The criterion for the success of any of these materials or processes is whether cost can be lowered without sacrificing quality of performance. It is the objective of the industry to make sure that the taxpayer's dollar will, in the future as in the past, buy the most highway, of the best possible construction, at the lowest possible cost.

Drilling, blasting, loading and hauling—early operations in the building of a modern road. New highways will go through hills; not around nor over them.

The New America
That's Coming



NEW EXPRESSWAYS... NEW CAR DESIGNS...

By Joseph Geschelin

LOOKING 15 TO 20 YEARS INTO THE FUTURE, what will be the character of passenger cars? We think they will be not only different but will be influenced materially by the kinds of highways and roads stemming from the multi-billion dollar road-building program now authorized.

The postwar record of developments in engineering and manufacturing is one of receding horizons. Scientific progress today is so highly accelerated by comparison with the past that one must shed conservatism and credit the future with things that may appear fantastic now. New materials, perhaps not yet in laboratory crucibles, may revolutionize our concept of gas turbines and perhaps even more advanced types of engines that may play a vital role in lighter vehicles.

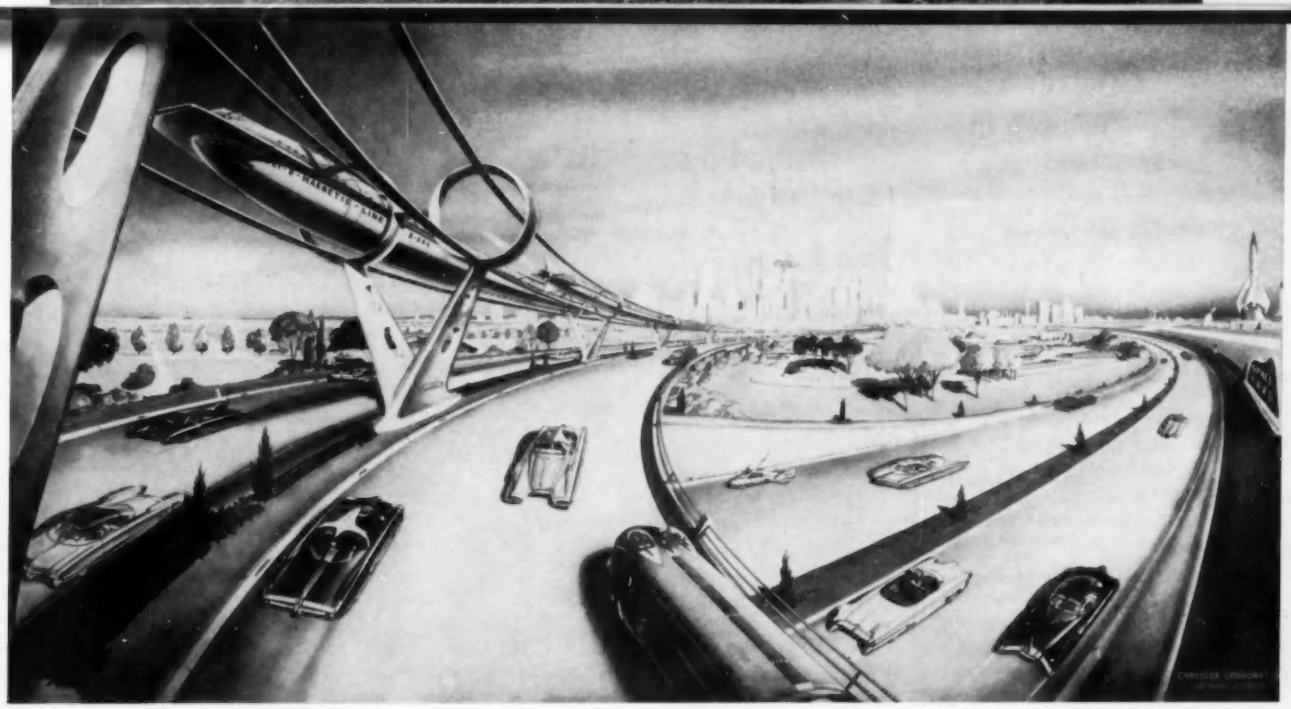
We doubt whether any previous decade has seen so much progress in manufacturing techniques. If developments continue at the same pace, it is in the cards that the car of the future can be equipped with the gadgetry and electronic accessories now in the dream stage, at prices within the reach of the mass of car buyers.

Rear engine cars have been discussed off and on for the past 20 years. They are no novelty in Europe. And Bill Stout's Scarab of an earlier era demonstrated its capabilities. There are several reasons why rear engine cars have not been adopted for the mass market. One of the most important is the unfavorable distribution of weight with present powerplants and drives. Stylists and engineers are so sure this situation will change radically with future lightweight construction, that they are giving rear engine location a new look.

None of the projections of future car registrations and the higher plateau of motor vehicle production, placed close to 9-million cars a year by 1975 by the author in his paper presented before the American Chemical Society in Dallas (See AI, April 15, 1956) are conceivable without the new highways and roads. They will make a reality of the trend to multiple car ownership by encouraging a more rapid movement of our population to the suburbs and what is now undeveloped countryside.

What do some of the top automotive engineers foresee in the coming years? The car of the future has been visualized as lower with less overall length but more wheelbase, little or no chrome trim, more glass to the point of an all-glass roof. The driver probably will have at his disposal more power, more safety features, an automatic non-skid device, and improved braking and ride.

Improved high speed braking will be a necessity with increased performance, particularly if the superhighways of the future permit speeds ranging from 80 to 100 mph. When that period of development is approached disk brakes may be needed. Another feature of the car of the future is some form



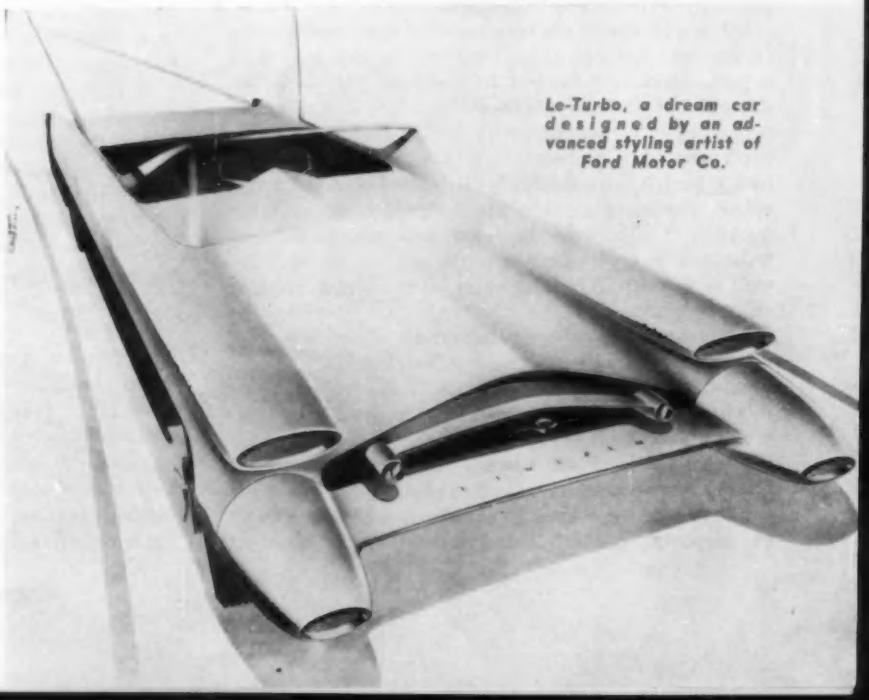
of device to provide a level ride under all load conditions. We can point here to the Packard torsion-level system which, doubtless, is the forerunner of simpler and less expensive mechanisms.

Some form of automatic parking device may be standard equipment. In our view we might look to European designers for some of the dream ideas. They offered built-in jacks and automatic parking devices in the years before the war. Perhaps engineering talent and manufacturing techniques still in the formative stages may lead to simpler and less expensive versions of these older ideas.

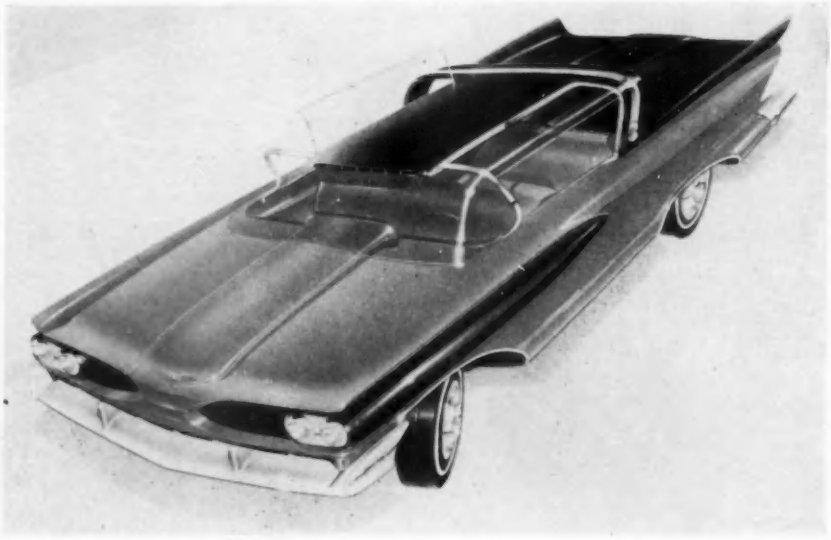
Some engineers are inclined to the view that motor cars may evolve into three specialized types. One of these might be a large luxurious highway model for safe, high speed intercity transportation, featuring a transparent roof. The second type could combine maximum passenger space and maneuverability in a small package. The third type would be a sports car for travel over secondary roads.

Consider these types more in detail. The highway model would be longer, lower and wider than today's cars, with a much lighter and somewhat smaller powerplant, mounted in the rear, to give a flat floor and better aerodynamic shape; also to better isolate the passenger compartment from powerplant and drive train noise, as well as heat. Propulsion might be turbo-electric or with direct-coupled turbine with power transmitted to all four wheels.

The passenger compartment would have spacious accommodations for six people, with movable seating, instantly locked in place by an emergency warning system, coupled to obstacle warning (if we have electronically controlled through-highways) and deceleration controls. Since weight will be a problem, it will be necessary to resort to an extensive use of



Le-Turbo, a dream car designed by an advanced styling artist of Ford Motor Co.



The Ford Dearborn, an "idea" car from which features may be taken for future production

light-weight materials as well as new structural techniques.

The second type would be smaller, less complicated, probably not much different from present cars, with capacity for four people in fixed seats. The power plant could be located in the rear to give a flat floor with drive to the rear wheels only. It would be a medium speed car for general use and since acceleration will be a major consideration, light weight will be of chief importance.

Assuming that this type of car will travel only on assigned lanes of electronically controlled highways, it will be equipped with many power controls and, if not with automatic guidance control, perhaps with obstacle warning devices. It will be intended primarily as a work horse, running errands in suburban areas. The car will be air-conditioned and probably will have a transparent roof.

Some new materials may be used for construction of the car. For one thing, molded plastics may find a place in panels subject to bumping and abrasion damage. Most body surfaces that are not of glass may have either a permanent surface finish or a color incorporated in the material. A new type of glass-like, transparent material is visualized with the properties of glass plus structural strength and lighter weight. It may even incorporate a molecular film polarized in such manner as to achieve privacy as well as protection from the sun—a version of present one-way glass.

Visionaries have been dreaming about expressways equipped with electronic control of traffic lanes that would take over the operation of a vehicle once it was switched to a given lane. The idea is to employ radar and other electronic devices controlled by officers stationed in towers along the highway. Others have visualized mechanism in cars responding to radio beams such as the systems now employed at airports, control being exercised by control towers. More recently, such a picture of future highway control has been shunned by competent spokesmen. Maybe it is too visionary for our generation.

In any event, there may be the possibility of using electronic and electro-mechanical devices for obstacle warning, deceleration, and guidance. One arrangement might be an electro-magnetic field strip laid on the highway surface, furnishing a guidance signal which can be sensed and amplified into steering commands. It would maintain vehicle direction on curving roads, in cross winds, and around other vehicles. When integrated with the obstacle approach warning mechanism, the device could transfer the vehicle safely into another channel, with speed and necessary traffic delay being automatically controlled during the passing maneuver. The vehicle then would carry on until returned to manual control upon turning off the highway or until brought to a stop by automatic cut-off at the highway terminus or upon approaching an obstacle.

It might be well to take a look at tires when we talk about expressway speeds of 80 to 100 mph. The fact is that motor car tires today are not designed for regular operation at such speeds. It implies that the tire companies will have to work on the development of tires capable of handling the car of the future with the same degree of safety and endurance that we enjoy today.

Looking to the future, the biggest IF in the entire picture is the question of what kind of engine we may have by then. Will it be an evolution of the high compression overhead valve V-8; will it be a gas turbine or a free-piston combination; or something entirely different. We shall look to the experts for some of the speculation. The nature of the fuel will be an important consideration. If we still use high octane gasoline, it is of interest to note that one well known petroleum expert estimated recently that an

average increase in fuel economy of just one mile per gallon would conserve 1.8-billion gallons of gasoline per year. This is a breath-taking prospect and one that deserves a great deal of attention. In fact, it is a matter of national concern in view of the anticipated increase in vehicle registrations.

The high performance, overhead valve V-8 still has a long way to go before it becomes obsolete since advances are being made hand-in-hand with industry-wide developments in the gas turbine. Several experts now believe that the gas turbine may emerge as a commercial powerplant for motor vehicles within the next 10 years. Its appearance may be hastened by the availability of new high-temperature materials not yet known.

So far as the V-8 engine is concerned, a compression ratio of 11 to 1 may be the optimum, considering that peak pressures go up so much more rapidly than does the payoff in economy. Meanwhile, the six-cylinder engine may continue to account for an important part of the market for the next 10 years, although with further increases in compression ratio its structure may require seven main bearings.

The overhead camshaft engine is something to consider in the future. It involves problems of cost and noise. But if these can be solved, this type of engine can offer an additional increase of some 10 per cent in engine speed.

Another promising avenue of improvement in engine performance is fuel injection. There are perhaps eight or more major companies working on its development and some, including American Bosch, Thompson Products, Holley Carburetor, Borg-Warner, Rochester Products Div. of GM, and Bendix already have announced their offering. Given sufficient manufacturing volume in the future, perhaps in the next few years, the fuel injection system or a pressure carburetor should be produced at reasonable cost. While it will take some time before such systems can compete on equal terms with a four-barrel carburetor induction system, it might be justified on many high priced cars today.

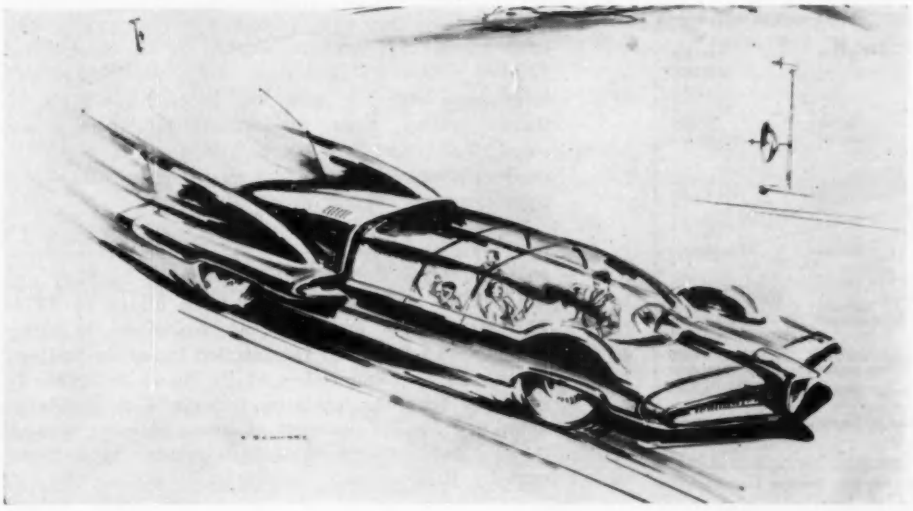
Another avenue of improvement is the turbocharger. True, it is an expensive accessory for motor cars, but projected designs offer an increase in output of 100 per cent. Even if the overall cost of the power plant is higher, turbocharging promises engines of smaller displacement, hence some degree of size and weight reduction.

Finally, there seems to be no doubt as to the future of gas turbines. Problems of high speed and high temperatures still remain. The same is true of fuel consumption, although this will be improved as a matter of course if we can build commercial gas turbines capable of operating at high temperatures. The appearance of commercial gas turbines has been predicted within 10 years and not more than 15 years. Perhaps this timetable can be speeded with new high temperature materials not known at this writing.

Regardless of when the gas turbine becomes a reality, you may be sure that the shift in powerplants will be gradual rather than precipitous. This means that the V-8 of the future, whatever its shape at the time, will persist side by side with the gas turbine for 10 years or more. A compelling reason for this is the huge investment in engine building plants that would have to be made in the changeover and the time it would take to make the shift.

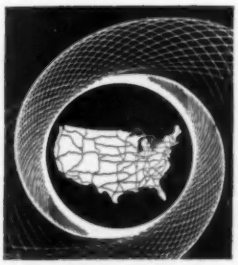
This implies that a large market for fuel, lubricants and anti-freeze, and the other supplies and parts for gasoline engines will persist for many years after the gas turbine becomes a reality.

Riding comfort remains a concern for motor car designers. Air ride has become accepted on heavy duty vehicles during the past year. Air ride has been considered for motor cars since prewar days and perhaps it is not too far off today. Certainly if we have a new concept of motor cars in the future, we shall have to supplement it with radical changes in suspension and brakes and control.



The Highway Cruiser. Illustration courtesy Chrysler Corp.

The New America
That's Coming



MOTOR TRANSPORT BOOM

By Leonard Westrate

ALL SEGMENTS OF THE NATION'S ECONOMY stand to benefit substantially from the gigantic highway construction program just now getting underway. However, probably no other industry will experience as great a boom as the motor transport industry.

Sometimes referred to as "adolescent" because of its comparative youth in the American economy, the trucking industry has experienced an amazing growth which is all the more remarkable because it has been made in the face of a miserable and archaic highway system and a hodge-podge of laws, restrictions, and regulations. As the new transcontinental network of broad, smooth, high speed heavy-duty highways unfolds during the next two decades, connecting all major metropolitan centers, this vigorous young giant will flourish at an unparalleled rate.

Along with this burgeoning growth will come a flood of collateral benefits to literally hundreds of other business enterprises that are both customers of, and suppliers to, the trucking industry. As an increasing tonnage of the nation's movement of goods flows to motor transport because of faster service, flexibility, and/or lower competitive rates, new and larger markets will open up for manufacturers of trucks, trailers, tires, replacement parts and accessories, fuels and lubricants, and for thousands of vendors who supply both the manufacturers of basic equipment and the operators of the vehicles.

As can be seen from Chart I, annual expenditures for equipment, fuel, tires, labor, and replacement parts and accessories for the trucking industry are expected to increase to nearly $63.5 billion by 1975. The estimate is made by the American Trucking Association's Research Department based on findings of the Paley Commission study made in 1950. It indicates that the trucking industry's expenditures accounted for 7.5 per cent of gross national product in 1952 but that the ratio will increase to 10.2 per cent by 1975.

CHART I

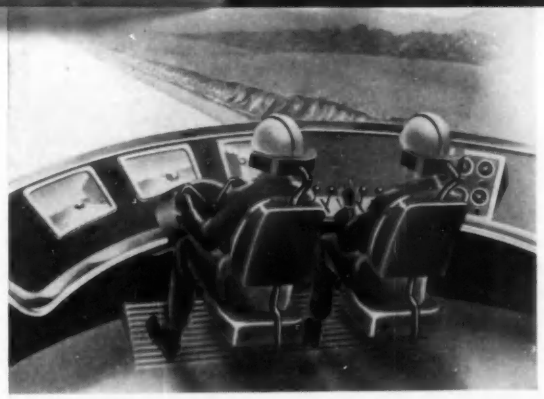
OUTLAYS FOR TRUCKING

1952 $27,247,000,000 — 1975 $63,488,000,000

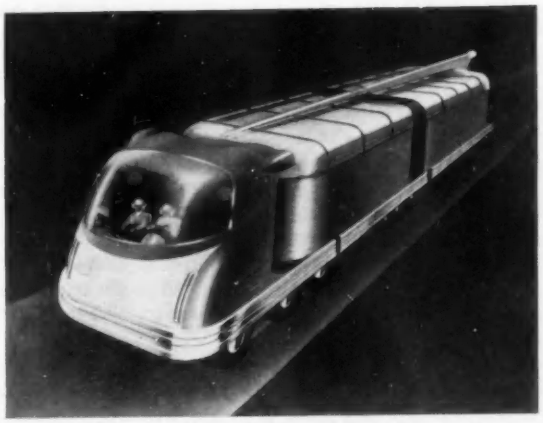
EXPENDITURE FOR SELECTED ITEMS

	1952	1975
NEW TRUCKS AND TRACTORS		
UNITS	812,000	2,285,000
COST	$2,160,000,000	$6,076,000,000
NEW TRAILERS & SEMITRAILERS		
UNITS	58,000	175,000
COST	$304,000,000	$920,000,000
REPLACEMENT TIRES		
UNITS	10,699,000	22,000,000
COST	$450,000,000	$924,000,000
REPLACEMENT PARTS & ACCESSORIES		
COST	$1,282,000,000	$3,240,000,000
MOTOR FUEL (000 gals.)		
UNITS	10,793,000	28,000,000
COST	$2,051,000,000	$5,400,000,000
LABOR		
UNITS	6,000,000	13,800,000
COST	$21,000,000,000	$47,000,000,000
TOTAL	$27,247,000,000	$63,488,000,000
GROSS NATIONAL PRODUCT	$360,100,000,000	$625,200,000,000
PERCENT TRUCKING OF GNP	7.5 %	10.2 %

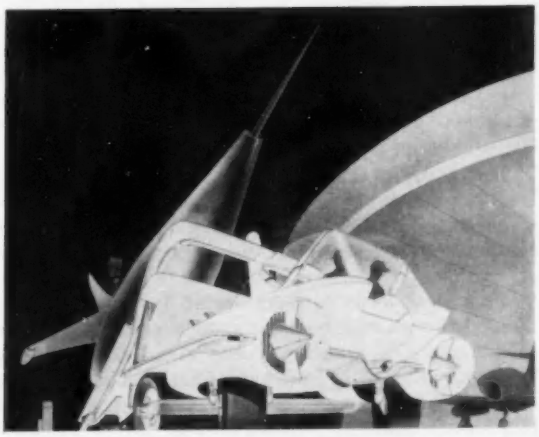
Source: American Trucking Associations, Inc.



Concept of futuristic giant highway transport vehicle envisions pilot and engineer crew. Pilot house has television scanning of traffic at direct rear and right and left rear. Headrest helmet contains radio headset.



Tractor-trailer of future features close axle spacing for optimum load distribution. Back of cab is contoured for closer coupling of trailer.



Artist's conception of possible future highway tractor. Twin turbines are mounted at the front; the guided missile is cargo only.

The highway construction program itself is going to have an appreciable impact on truck sales. Road builders estimate that for each billion dollars of additional construction, 57,000 more motor vehicles, mostly trucks, will be put into use. This would indicate requirements for at least 1.5 million additional trucks for roadbuilding alone during the period of the current highway construction program, not counting normal replacement.

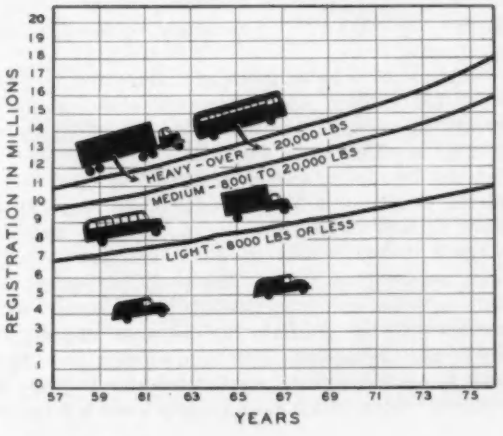
To appreciate the exciting potential of motor transport in the next two decades it is necessary only to look back the same distance and review the progress made by the industry in the face of inadequate highways, restrictive legislation and determined opposition from long established other competitive forms of transport.

In 1935 truck registrations totalled 3,645,000. Last year the number had risen to 10,250,000, a growth factor of 2.8 in 20 years. An interesting corollary is that the gross national product during the same period increased 2.7 times after adjustment for purchasing power of the dollar.

Using the gross national product as a base and estimating conservatively that it will grow at the rate of only 1.8 during the next twenty years to $720 billion, and assuming the same ratio of truck growth as existed during the past two decades, an extremely conservative estimate of motor truck population by 1975 indicates at least 18 million. Actually, that figure appears to be conservative in view of predictions by some industry groups which look for as high as 24 million. Consequently, in view of the impetus to truck use expected from the new highway program, a total truck population of 20 to 21 million by 1975 appears reasonable.

Trailer manufacturers also can expect a bright future from the impact of the new highway program. Earlier this year Prof. M. J. Barloon, in a study for Aluminium Company of America, forecast production of 97,000 trailer units annually from 1956 through 1960 compared with 62,500 for the previous five years.

Estimate of
COMMERCIAL VEHICLE REGISTRATIONS
1957-1975, by Weight Groups



From 1961 to 1965 the curve will continue upward to an average of 114,000 a year. During the next five year period ending in 1970 average annual production is expected to hit 143,100 and to rise to 165,800 between 1971 and 1975. The estimates are based on 75 per cent of highway freight movement on trailers with the balance moving on straight trucks.

Another indicator pointing to a fabulous future for motor transport is the continuing upward curve of total freight movement carried by trucks. In 1949 about 75 per cent of the 8.3-billion tons of freight moved in domestic commerce was carried by trucks. By 1951 total freight volume had increased to 11.1 billions with trucks accounting for nearly 77 per cent. Currently it is estimated that motor transport accounts for about 77 per cent of the nation's 13-billion tons of freight movement. In 20 years it is expected that total freight tonnage will be 30 billion tons of which at least 80 per cent, or 24 billion tons, will move by motor truck.

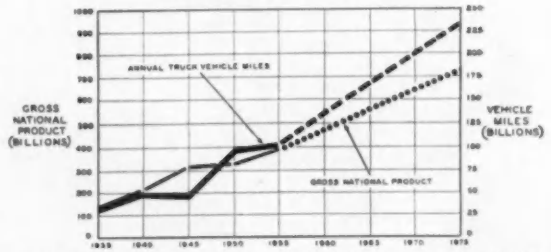
The increase in truck vehicle miles is expected to show a similar startling upsurge. Year by year it has been increasing at a steady rate totaling about 113 billion vehicle miles last year. This figure is expected to rise to approximately 237 billion vehicle miles annually by 1975.

The new $27.5 billion national highway program will buttress the growing dominance of truck transport in the coming years, not only by making faster lower-cost transportation of goods possible, but in other ways as well. It will accelerate the movement of population away from metropolitan centers to suburbs and much further outlying rural areas, enlarging existing communities and creating entirely new ones, most of which can be supplied only by trucks.

The role the motor truck has played in helping obsolete cumbersome warehousing systems in manufacturing will become even more important as a result of the new highway program. During the past 15 years manufacturing industry has decentralized from a costly large home-plant setup involving a large inventory, to a system of interplant movement of goods to final processing. In this scheme of operation trucks, because of their speed and flexibility, act as mobile warehouses. Whereas railroad facilities once were a guiding principle in plant location, access to express highways now is assuming equal or superior importance.

Building of 41,000 miles of interstate highways under the Federal Road Program plus the limited access expressways through and around cities are certain to effect some dramatic changes in location of truck terminals, and the methods of operating as related to city and intercity deliveries. Already the trend is well defined for large trucking operators to locate terminals near so-called loop expressways in large metropolitan areas. This permits them to send their vehicles out over the city expressways which connect with the intercity highways on long distance city-to-city operations. City expressways also permit them to distribute with smaller vehicles to important business centers much more rapidly since a large part

1956-1975 TRENDS



Source: Automotive Industries' Calculations for 1956-1975. Trends are interpolations of high and low estimates for these years by Industry and Government sources.

of the mileage can be on the limited access city expressways.

Looking ahead 20 years in truck design naturally is a difficult assignment for anyone not blessed with clairvoyant vision, but there are certain reliable guideposts that point to the future. One is the well defined trend established in recent years toward a higher ratio of larger and heavier units. That trend certainly will accelerate as more miles of wider, stronger, straighter highways, extending long distances without the normal impediments of stop lights, intersections, cross-overs, steep grades, sharp curves, and congestion of traffic near cities, unroll across the face of the nation.

There is considerable opinion now that the highway program may make economically practical a distinct separation of strictly highway vehicles from the all-purpose motor truck being built today. This would result in larger, faster, more maneuverable units specifically designed to operate at high efficiency at maximum loads on cross-country runs at high, sustained speeds. Distribution of goods from terminal points would be made with more or less conventional trucks as they are known today but altered to some extent to give more speed and flexibility since they would not be required to be equipped for long distance over-the-highway use.

One of the greatest benefits that may be derived from the new highway program and which must come before the specially designed maximum freight motor equipment can be utilized would be some semblance of uniformity in weight, length, width, and axle loading regulations between states. Insistence by the Federal Government on some semblance of uniformity or adherence to a national code would eliminate the "Balkanized" system now prevailing, and prevent the type of low-maximum barriers across the nation's mid-section that can be seen in Fig. 1.

Of special significance will be results of tests to be conducted by AASHO at Ottawa, Ill., to determine types of highway construction required for moving heavy motor freight loads without undue damage to roads. Final results of the test will be available by 1960 and it is conceivable that after that time weight regulations may be liberalized. Another development which may affect truck and trailer design would be modifying or perhaps eliminating the so-called bridge

formula which regulates and designates axle spacing.

Greater overall legal width already is indicated, since some states have legalized 108 in. maximums and it is the trucking industry's hope that it will become universal before too long. With the wider highways now being built the 8-ft. 6-in. maximum is practicable and reasonable. It would provide not only greater stability and cubage but importantly would provide more inboard room for brakes which, admittedly, has been a limiting factor.

There also is no reason why truck lengths should not increase in all states up to at least the 60 ft overall combination lengths now permitted in some western states and even go beyond that. Here again uniformity between the states would play an important role in permitting standardization on special purpose highway vehicles.

With the advanced art of highway construction there is every reason to believe that axle weight loads will be substantially increased. Truck and trailer builders are reluctant to guess many years in advance on this question but a few have indicated 23,000 to 24,000 lb per axle legal loads are entirely possible, particularly since some states now permit loadings not too far below that figure. Also certain to come is more weight on the front axle through changes in design to shift weight distribution forward.

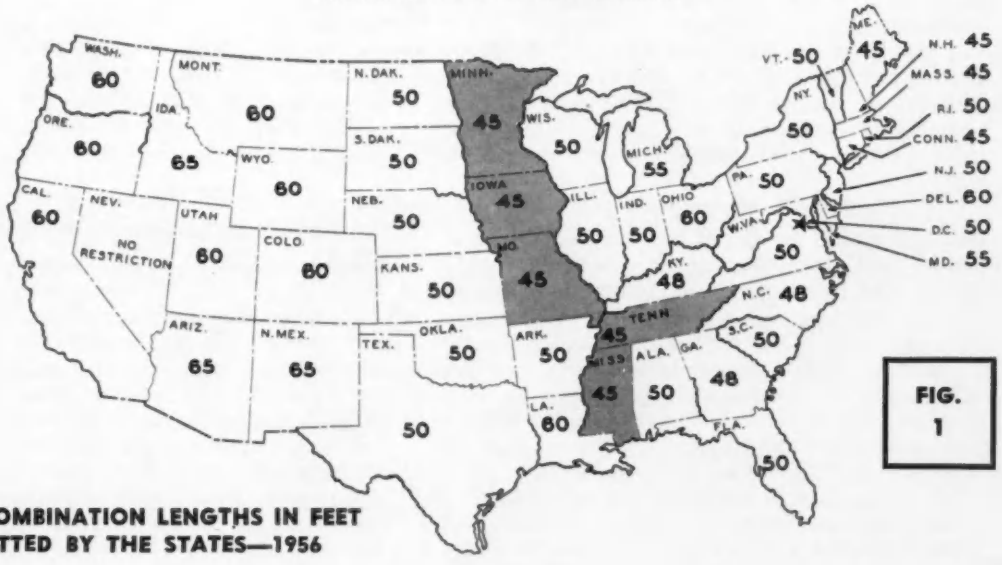
Directly related to the axle-load question is the weight of the vehicle itself. Truck and trailer builders have been active in developing lighter vehicles with adequate strength to carry maximum loads. One of the most promising developments and one which certainly will be in common use long before 1975 is air suspension for trucks and trailers. It is estimated that at the outset about 800 lb can be taken out of the standard truck equipped with air suspension, and this figure is expected to increase appreciably as the industry gains more experience. Weight is saved principally through use of lighter structural members made possible by the air bellows absorbing road shock, reducing impact on chassis members.

Most optimistic estimate is that with further refinements in the air suspension system and possible use of plastic cabs, fenders, and certain other components, nearly two tons of weight eventually can be taken out of the highway tractor. Use of light metals is a growing practice in the manufacture of both trucks and trailers.

Not only will goods move much faster by truck along the new inter-state system, but they should move at lower cost. According to a Highway Research Board Report made two years ago, improved roads result in savings of 0.03 gallons of gasoline per vehicle mile. Applied to the 15 billion yearly rural truck vehicle miles on the interstate system, a conservative application of this saving would mean 450 millions of gasoline annually. Admittedly an undetermined part of highway mileage is accounted for by Diesels, but savings should be proportionate. Figured at 25 cents a gallon, the annual dollar savings would amount to $112.5 million, which might be reduced to $100 million if the lower cost of Diesel fuel is factored into the estimate. There is no doubt that there would be collateral savings in brake and tire costs, but there are no adequate data at the moment on which to formulate a definite figure.

The Board estimated that in 1953, over inter-state routes, trucks averaged about 25 mph in comparison with 40 to 60 mph on freeways and other improved rural routes. If truck speeds are estimated at 30 mph today on the average rural highways, and at something in excess of 40 mph over improved routes, a saving of 125 million hours from improved highways

"BALKANIZED" SYSTEM PREVAILS



TRUCK COMBINATION LENGTHS IN FEET PERMITTED BY THE STATES—1956

FIG. 1

is indicated on annual estimated 15 billion rural truck vehicle miles. Assuming a conservative figure of $2.50 per hour, the time saving in rural truck mileage would exceed $300 million annually on rural routes alone. As truck usage increases over the next two decades, the savings will mount proportionately.

In recent years cubage has become increasingly important and truck design is already reflecting the need for more load carrying space within overall length limitations. This has resulted in a definite trend toward cab-over-engine models with extremely short bumper to back of cab dimension. This trend certainly will continue and even be carried much further. In fact, there has been some speculation that tractor and trailer might eventually be confined into one integral unit, perhaps articulated for maneuverability.

It is estimated that a vehicle of 50,000 lb gcw would require a 700 hp powerplant to sustain 60 mph speed on a six per cent grade. That would be 3-½ to 4 times the present level of some 165 to 200 hp engines now used in such vehicles. Even if such a high capacity powerplant were available today without undue penalty of size or weight, the savings in ton-mile revenues per day would not be sufficient to cover additional investment and operating cost because of time lost in traffic delays with the present congested highway system. However, when the present road program is completed and much higher sustained speeds over long distances are possible the way will be open for much larger powerplants on a practical basis.

The development of unimpeded-flow highways which permit long-sustained, high speed operation would seem to give impetus to the turbine or free piston engine. The turbine, particularly, operates most efficiently at high speeds and under full load, a condition which certainly will exist with the non-stop highways envisioned within the next two decades. The free piston engine also appears to have a very definite future for commercial vehicles, but not enough is yet known about it to forecast any particular time table. The turbine and the free piston engines are unfinicky in their fuel appetites, which is no small consideration in motor truck operating costs.

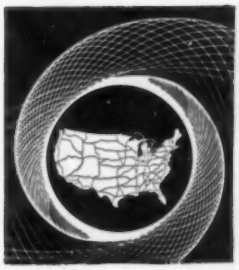
Conventional reciprocating gasoline and Diesel engines also will undergo improvement and refinement in the years ahead, however, so it will be brutal economics that will decide which type powerplant is best suited for operating conditions existing two decades from now.

Meanwhile, the trend during the next few years certainly appears to be toward higher horsepower which can be accomplished without material change in the weight or bulk of the engine. The trend definitely is toward shorter, more compact engines of the V-8 type with shorter stroke and higher rpm. Higher compression ratios consistent with currently available octane fuel values, increased volumetric efficiency through improved breathing or superchargers, and fuel injection to replace carburetion are definite possibilities for the near future.

Diesel engines in trucks also appear destined to increase. This type engine not only will continue to be improved, but also will become lighter and more compact with higher horsepower. It is not likely, however, that the Diesel will supplant the gasoline engine in medium to small vehicles, particularly those used in city hauling and delivery.

GROSS COMBINATION WEIGHTS AND TRAILER LENGTHS ALLOWABLE—BY STATES

The New America
That's Coming
▼



NEW AMERICA
E-X-P-R-E-S-S-W-A-Y BUSES

By Charles A. Weinert

IF SOMEONE WERE TO SAY WITH CONVICTION that highway buses of the immediate future were going to be atomic-powered, it would not be at all surprising in view of some of the imaginative designs which are being proposed. While progress is unquestionably spurred by imagination, the chore of forecasting the New America bus of 1970 is made somewhat involved and uncertain by these revolutionary proposals. Another complication is the usual situation of authorities in the industry having understandable variances of opinions. We are, of course, setting the stage at 15 to 20 years hence, when the national superhighway network, measuring some 41,000 miles, will be completed and in operation.

Effect of New Highway Facilities

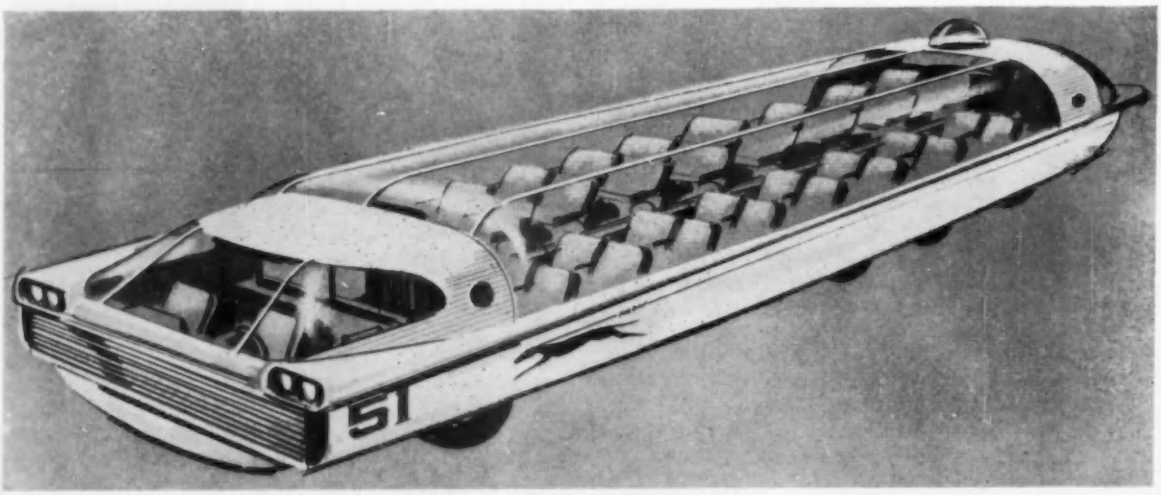
The new highway facilities will unquestionably expand intercity travel by bus. Fast schedules, resulting from the higher average road speeds thus made possible, will draw additional riders to this economical mode of transportation. There will be more people living in outlying suburban areas, and they also will add to the volume of traffic handled by bus on the highways. Riders will become more and more attracted to mass transportation for going to and from their places of employment. This is perhaps contrary to the general idea of bigger and better highways, but we must not overlook the traffic-congestion potentialities of the future, and especially the limited parking facilities available in work areas. Increased riding, in turn, will allow greater frequency of service to be offered by the operator—a convenience factor which is additionally attractive to the individual.

The expansion of traffic handled will obviously mean the need for more vehicles. This need can conceivably double, numerically, the present requirements for highway buses. As a net result, bus production can, and will be, at a materially higher rate, both for new and replacement equipment; assisting, among other things, the manufacture of advanced designs at economically-feasible unit costs.

Bus Passenger Appeal

In approaching the matter of bus design, and since bus design is fundamentally influenced by certain rider considerations, it might be well to first review some of the older aspects such as passenger appeal. Parenthetically, we wish to state that when making references to "improvements" in coaches, these are not intended to be reflections upon current designs which are very attractive in many respects. Perhaps the better term would be "refinements" for taking full advantage of the new highway facilities.

The bus operator is obviously interested in minimum capital investment for equipment and economy of operation. Perhaps even more important is the



Intercity coach, design study. This "Bus of the Future" is gas-turbine powered, and in addition to its streamlined design includes features such as passenger television sets, "a special tinted roof," lavatories, an observation dome, "fog-piercing" headlights, and a separate driver's compartment fitted with rear-view television screen. (The Greyhound Corp.)

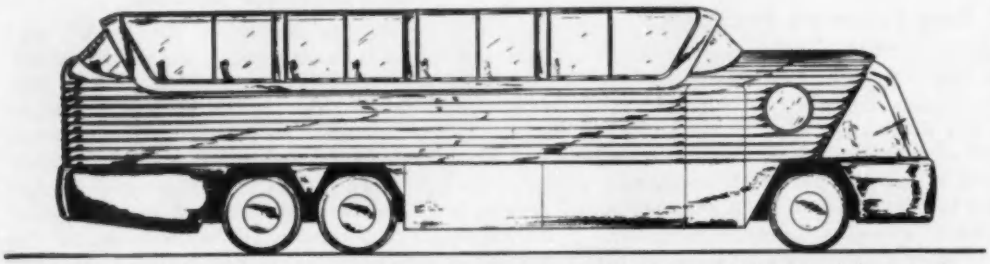
attraction of riders in large volume, which is the crux to the success or otherwise of the operation. It can therefore be expected that the emphasis continued on future buses will be toward advanced styling or more eye appeal, more comfortable accommodations, added conveniences, and a quiet, smooth ride. Reliability of operating schedules, minimum of time consumed in travel, and economical fare structures will also continue to enter into the picture of rider appeal. Additional factors, tied in with the passenger and/or the bus operator, are safety, improved roadability of the vehicle, added vehicle performance, light vehicle weight per passenger carried, absence of fumes, improved visibility for the driver, and faster passenger and baggage handling. Many of these factors have a direct bearing on vehicle design aside from those dictated by other management considerations and by individual operating conditions involved.

Operating Conditions

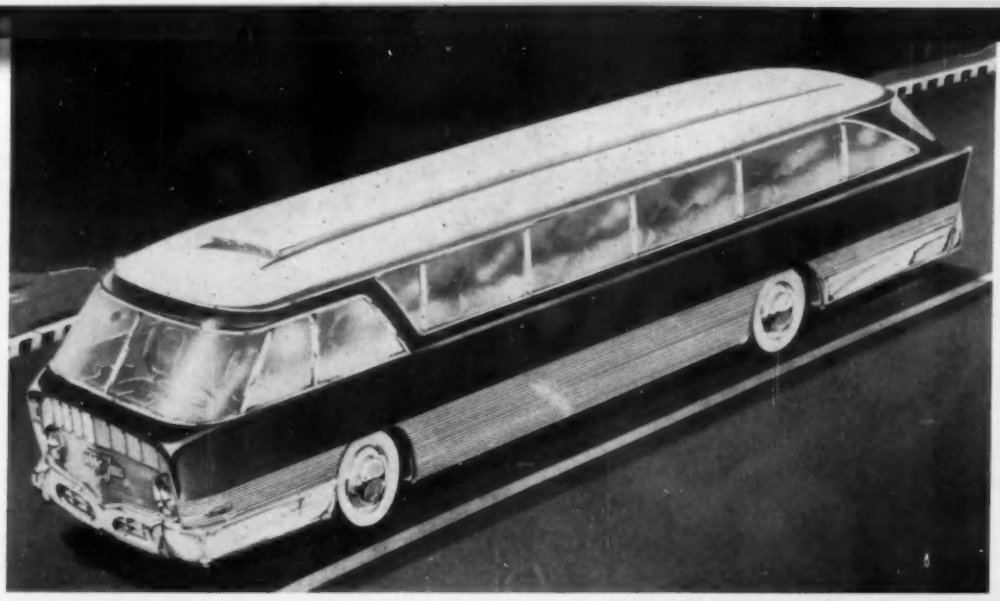
In attempting to predict future general types of operation or service and their influence upon bus design, and having in mind long-distance open highways, it is visualized there will be main-line nonstop, express bus service for distances of 100 miles and over at cruising speeds of 80 mph. Also visualized is "commuting" or suburban service up to 50 or 75 miles (depending upon the locality) from industrial centers, with "railroad station" but not too-frequent stops and at cruising speeds of 65 mph. It is further visualized that these two classes of service, long-distance and commuting, both running on the new highways, will terminate their runs at "land ports" located in city fringe areas, where local buses will act as feeders to and from the highway services. Consequently, it would appear that the highway buses need not operate in city traffic, and could therefore be designed specifically for highway operation and without taking into consideration the compromises heretofore required for maneuverability and handling in heavy traffic.

Long-Distance Buses

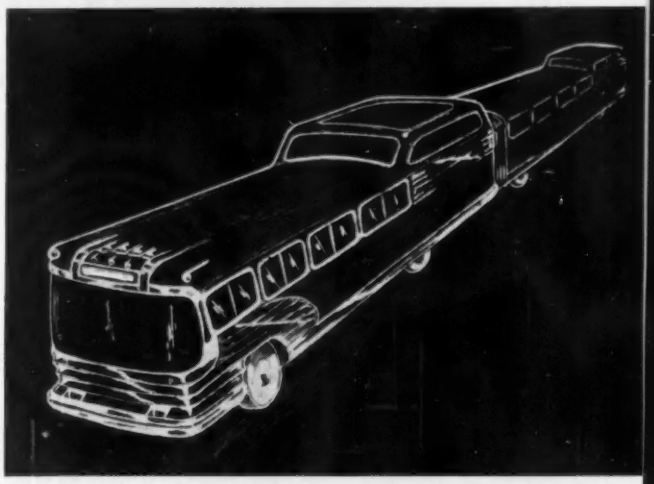
Now that we have set forth a general background,



Intercity coach, design study. A single unit, elaborate in the way of picture windows and driver visibility. Lower body is designed for massive appearance, appearing to have a wide bumper and rub rail extending completely around coach. All passengers would ride on upper level, with space below used for baggage, freight and mail. Front compartment is usable as an observation lounge, including snack bar. (The Fixible Co.)



Intercity coach, current model. Ghia of Turin styled the body of this 40-passenger luxury coach made by Leyland in Britain, and now offered on an improved Worldmaster chassis. Glass area is almost unbroken, and the roof incorporates an air scoop with a ventilation duct extending nearly its full length. The 150 hp Diesel is mounted underfloor, and drives through a semi-automatic Pneumo-Cyclic gearbox to give two-pedal control.



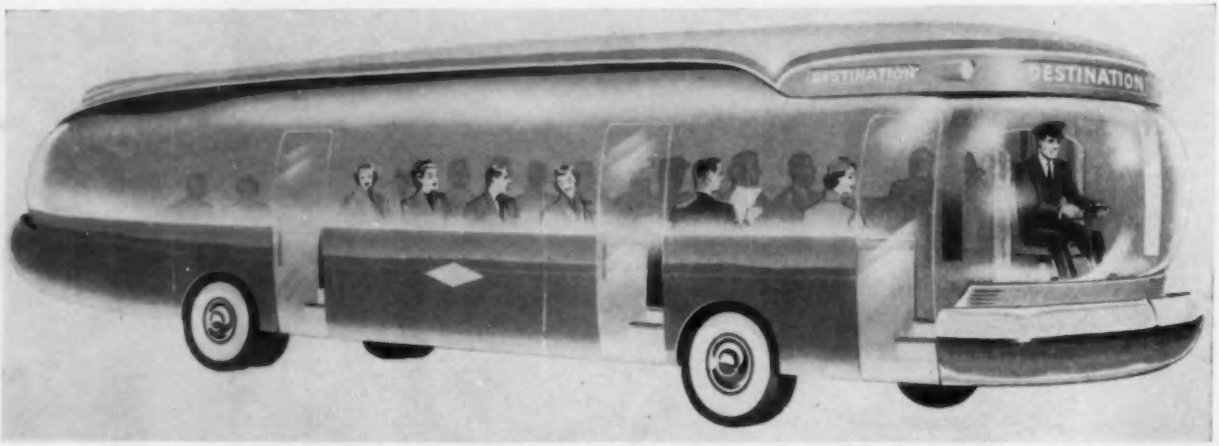
Intercity coach, design study: Two separate units, one powered and one trailer; each with upper and lower seating levels. Powered unit would start on its journey in the morning and in late afternoon would pick up the trailer section. In this way, sleeping accommodations could be provided for all day coach passengers. (The Fixible Co.)

and upon the premise that under the plan expressed above the buses for long-distance operation would run solely on the highways, the following prognostications are made with respect to this class of vehicle:

It is felt that in order to provide adequate passenger accommodations, the vehicles must be both longer and wider. Depending upon the type of unit employed, i.e. single unit, tractor-trailer, or even possibly a two-unit (with trailer) combination, and individual operating requirements, the length will probably range from a minimum of 40 ft to perhaps as long as 60 ft. From a standpoint of overall width, it is considered essential that a minimum of 102 in. and preferably 105 in. be used. The 96-in. width of vehicle for intercity travel has for many years been a severe restrictive item in the design of buses for ultimate passenger comfort. Seats of about 36/38-in. for two passengers and aisle widths of around 14/15-in. are not conducive to the best of accommodations. Width of vehicle also enters to a degree into the safety aspects of bus operation, since with the universal need for dual tires the spring centers at present are necessarily closer than desired. Roadability of vehicle could consequently also be improved with wider vehicles.

To summarize this particular phase, it would appear that greater lengths and widths of vehicles are considered desirable and essential for highway service, and that these would be practical from an operating standpoint. We can only presume at this stage that highway planning will provide for their operation, and that suitable revisions in present regulatory limitations will be enacted.

The styling of the buses will undoubtedly change for added attractiveness, but whether it will include as much glass as is in evidence in the accompanying illustrations is a moot question. Unfortunately, large areas of glass usually cannot function as structural members, weigh much more than equivalent-size strength-structures of metal, require beefing up of understructures, and are not conducive to efficient air conditioning. Clear plastic also does not appear to be the solution for several of the same reasons, plus its relatively poor resistance to abrasion and scratching under exposure to road dirt. Suffice it to say, however, that in view of the general trend to more glass in automobiles and homes (and with due respect to stylists' renderings), there is every reason to believe that coaches of the future will likewise utilize more glass. Conservatively speaking, this



City transit coach, contest winner. Prize-winning futuristic "Bus of Tomorrow" designed from ideas submitted by A. E. Wolf, CTA equipment engineer in a contest sponsored by Chicago Transit Authority. The sweeping air-flow body is of "windowless" plastic, transparent from top of seats to roof line. Ideas included electric radiant heating in floor; individual seats with theatre-type folding cushions; three doors on each side of vehicle for curb loading and alighting either side of one-way streets; and an automatic co-pilot for straight-ahead operations. Also two-way turnstiles and change-makers at each door; air-conditioning by "electro-mechanical units of Freon-charged type," and a public address system.

might take the form of larger picture windows, a number of glass or plastic sections in the roof, and larger windshields. Tinted or polarized glass, for eliminating glare and reducing heat from the sun to benefit air conditioning, is likely to be in general use.

A snack bar is thought to be essential for long-distance buses. Likewise lavatory facilities.

Adequate baggage facilities, the perennial problem, still remains in the picture, perhaps more so than ever if the larger vehicles are to be practical. Bus heights could desirably be made lower for roadability reasons, but this also tends to work against the space available for baggage. The best solution to the problem seems to be the deck-and-a-half vehicle arrangement; although one authority feels this design will not be generally used, saying it is too difficult to move in and out of.

Air conditioning is considered a definite requirement. One authority has suggested the need for an air freshener and purifier, and the release of a pleasing odor into the passenger compartment.

Body and Mechanical Design

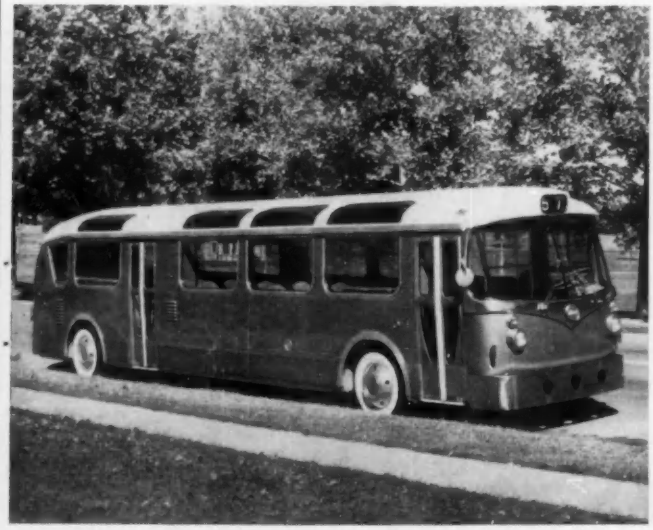
Again upon the premise that long-distance buses will operate solely on the open highways and as a result can be longer and wider, the designer is then faced with the problem of larger, basically-heavier vehicles and payload, combined with good roadability and adequate road performance. As previously mentioned, the general consensus is that the highway buses should be capable of cruising speeds on the order of 80 mph. It also felt that rates of acceleration should be vastly improved over present-day bus standards. Just how all of these conflicting factors are to be satisfactorily resolved can only be partially indicated at this time.

As a step in the above direction, it is interesting to note that bus manufacturers feel present piston engines will be supplanted with gas turbines or free-piston/gas turbine combinations. The gas turbine has a high specific output, favorable weight, compactness, and ability to burn low-grade kerosene. As presently developed it does, however, have a large appetite for fuel and the need for costly critical alloys in the high-temperature-operating blades; although both of these obstacles will undoubtedly be alleviated by future development. The free-piston engine likewise has a high specific output, favorable weight and compactness; and in addition has a fuel economy approaching that of present-day Diesels, as well as the ability to burn almost any kind of fuel, according to reports.

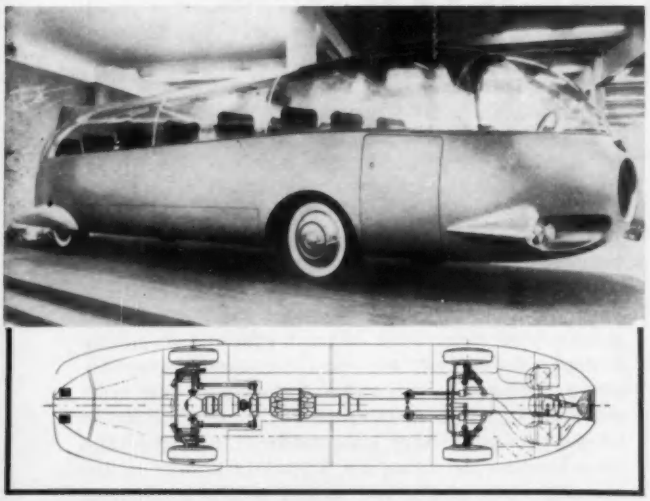
Conversely, other authorities are of the opinion that the piston engine should not be written off for heavy-duty service. Turbo-charged Diesels, with their inherently high fuel economy, and the potentialities of gasoline engines with compression ratios on the order of 10 or 12 to 1, both in combination with the extensive utilization of aluminum and magnesium, are not to be discounted it is said. Another observation which has been made is that if the piston type is continued in buses, it is probable that future engines, besides having higher specific outputs and fuel economy, will be of the smaller-bore, 12 or 16-cylinder V-type to improve smoothness of operation.

Automatic drives are pretty well taken for granted. They may be in the form of a torque converter in combination with an automatic shift transmission or a hydraulic shift multi-speed transmission without torque converter when used with the piston engine; or a simplified transmission when used with the gas turbine.

Brake drums on buses may become a thing of the past. Disk type brakes, with hydraulic retarders to do as much as 90 per cent of the work, appear to be the most likely prospects. It has also been stated



City transit coach, prototype. Said to be an "exploratory venture," this "Bus of Tomorrow" has a wrap-around windshield with a "plunging waistline," large picture windows, and "jet-age" exterior styling. Painted in a metallic bronze and white, it was received with enthusiasm upon its unveiling during the American Transit Association annual meeting held at St. Louis in late September. Equipment includes air-conditioning, radio-telephone, and fluorescent lighting. (Mack Trucks, Inc.)



Intercity coach, prototype. Called the "Golden Dolphin," this dorsal-finned test model (top) will eventually have a gas turbine engine. Body is of plastic integral design, roofed with polarized glass. Overall length is 37 ft 4½ in. (Officine Viberti, Turin, Italy)

Drawing of the "Golden Dolphin" gives an indication of the ultimate layout planned for the Fiat gas turbine engine, and other mechanical components. Suspension is of the independent, torsion bar type. Note the DeDion type rear axle.

that power brakes may be taken off the wheels and mounted elsewhere, for better ventilation.

Many bus manufacturing engineers seem to favor the air bellows type of suspension, pointing to softness of ride, the absorption of high frequency vibrations, the ability to provide a progressive rate of deflection, and the maintenance of a substantially constant floor level under varying load conditions. Others feel that independent wheel suspension, using torsion bars, has advantages, including wider support centers for bus stability, along with soft ride.

The use of multi-axles is likely to expand, with three axles being the general rule and four being used on the largest vehicles. The emphasis here will be on light weight through the use of higher-strength alloys, in addition to redesign for reduction of bus height to the minimum.

Redesign of the body structure, and the use of lighter weight materials, for minimum weight will be the order of the day. There is some question at this stage whether high tensile alloy steels, stainless steels, and aluminum will be supplanted by other materials to any great extent. Here again developments in the way of availability and economical cost for some of the newer materials can and probably will affect future choices. It does seem probable that spot welding will take the place of rivets, that higher-strength alloys will be utilized, and that glass-fiber reinforced plastics may find some use in paneling.

Commuting Service Buses

Only brief reference will be made to commuting service buses since their design features will largely be influenced by what is done on the long-distance buses. They will differ in some respects. For example, it is probable the commuters will be of single-deck design and equipped with comfortable high-back non-recliner seats and parcel racks; but no large baggage facilities, snack bars, lavatory facilities, nor television. As in the case of the long-distance buses, it is felt the commuters will and can be larger in size—perhaps 50 ft long and 102-in. wide minimum. The type of powerplant will probably be the same as that adopted for the long-distance cruisers, for uniformity of maintenance and to provide the performance necessary during acceleration for operating the fastest possible schedules. Here, also, the emphasis will be on passenger appeal; air conditioning is considered a must.

Local Transit Buses

It would seem remiss not to have local service buses represented in this bus discussion, even though they do not enter into the highway program and obviously will not operate on the highways as such. A great deal of thought has been and is being given to future transit bus design, principally aimed at attracting riders. Vastly improved styling, comfort features, better lighting, better heating, air conditioning, and a host of other features are in prospect, as will be evident from the transit bus studies illustrated in this article.

The New America
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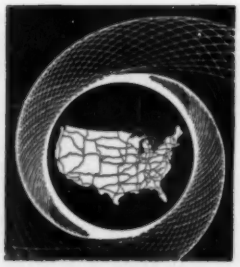

SUPERHIGHWAYS *Will Require* ADVANCED SERVICE FACILITIES

By Harry Roberts

AUTOMOBILES WHICH WILL USE THE NEW superhighways will require the same type of repairs as those operated on other roads, with more emphasis perhaps on wheel balance, cooling system efficiency, and other factors which affect proper operation at higher sustained speeds. However, service needed by cars while traveling the highways will be somewhat different.

The motorist on a long trip will not stop for most types of repair work unless he is forced to. Time-consuming jobs which are not essential will be done where and when the car can be dispensed with temporarily with the least inconvenience.

Experience on some of the present expressways has shown that many calls to service stations are from drivers whose cars are unable to continue under their own power. Running out of gasoline is the most common of all causes for these calls.

Tire trouble is high on the list of reasons for seeking help. With the large number of tubeless tires in use, equipment for repairs of these tires will be among the items carried by service trucks.

Due to the variety of makes and models of cars in use and the need for special facilities to perform some service operations, only minor repairs will be practical without taking the vehicle to a shop.

In order to handle vehicles which must be towed because of mechanical difficulties, in addition to those damaged by collision or roll-over, well-equipped service and tow trucks will be necessary. The New York Thruway, for instance, requires the independent garages operating under contract with the Authority to have available not less than three modern service trucks. One of these must be of the heavy duty type, provided with a crane capable of hauling a 20-ton tractor-trailer up steep embankments; the other two must be equipped to render first class service on the highway. One of the two lighter trucks is required to patrol the section of highway assigned to the service truck owner.

This illustrates the type of equipment which is considered necessary, but not the setup which will be found on the new highways. Monopoly of a certain length of road by any one shop owner could not be permitted. The Federal-Aid Highway Act of 1956 (Section 112) states that "All agreements between the Secretary of Commerce and the State highway department for the construction of projects on the Interstate System shall contain a clause providing that the state will not add any points of access to, or exit from, the project in addition to those approved by the Secretary in the plans for such project, without the prior approval of the Secretary. Such agreements shall also contain a clause providing that the state

TYPES OF SERVICE REQUIRED BY CARS ON NEW YORK THRUWAY

(Covering a Total of 10,047 Aids to Motorists)

Out of gasoline	3,416
Tow required	2,234
Tire trouble	1,701
Ignition faults	583
Unable to start	339
Out of water	327
Fan belt	289
Oil troubles	177
Gasoline line	148
Wreck	121
Carburetor	86
Battery	85
Lights	82
Brakes	26
Frozen radiator	25
Lock & key trouble	4
Miscellaneous	404

will not permit automotive service stations or other commercial establishments for serving motor vehicle users to be constructed or located on the rights-of-way of the Interstate System. . . ."

The effect of these provisions is to protect business, both small and large. By denying the use of the right-of-way for service and other facilities, it places them of necessity on private property, adjoining the right of way.

It rules out the possibility of state-operated facilities, and it also rules out the chance that the right to serve the motorist competitively might be taken away from the general business community and awarded to a single large company or a handful of companies. It makes it possible for small enterprises to compete for a share of the highway business.

The Highway Act does not, however, provide for actual location of service stations. This is left for the states and private industry. Supply and demand will no doubt take care of the location and number of service facilities.

In some instances, it may be necessary to establish entirely new service areas. They can be set up on private property along the state right-of-way, connected to the interstate highway by a service road which turns off from the highway and runs alongside it for the required distance, and then returns the motorist to the traffic stream. This technique will be used to incorporate present service facilities into the system, as well as to handle entirely new service areas. The Public Works Committee recently asked the Bureau of Public Roads for clarification of the policy which will be used in determining questions of access. The Bureau had this to say:

"If several farm entrances or private driveways, service stations, restaurants, motels or other establishments are located close together in such a way that there would be more than two entrances per mile on each side of the road, we would generally provide a parallel frontage or service road to join all of these driveways and then connect this frontage road to the through lanes of the Interstate System at one point. . . ."

There are several types of arrangements which offer solutions to the problem of repair shop location. Fig. 1 shows how, where no facilities are nearby, and where intersections are at a considerable distance, a new service area can be created. Here is the usual limited-access highway, but alongside has been constructed a parallel service road. Traffic swings off the highway, down the service road and eventually back into the main road.

The service road can be as long as desired. Service stations which are interested can be accommodated on private property fronting on the service road. In this figure, the service road is located on private land, off the state right-of-way. This is not the only possibility. The service road itself can also be built within the right-of-way, extending out to the edge of state property, but giving access to private property at that point.

The arrangement shown in Fig. 2 is a limited-access highway, sealed off by a wide right-of-way along most of its course. It is intersected, however, by an authorized feeder road which provides a point of entrance and exit.

Service facilities can be located on private property along the feeder road, just as they are now. Traffic entering the expressway can be serviced before reach-

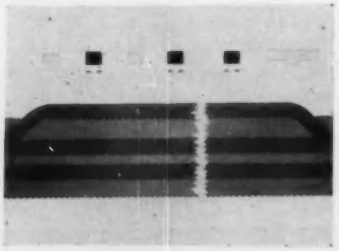

Fig. 1—A service area can be created on a new road paralleling the highway

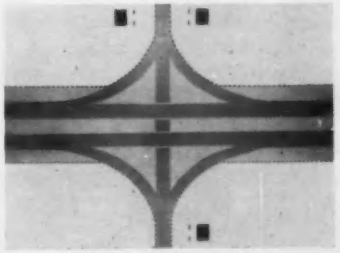

Fig. 2—Service facilities can be located on private property along a feeder road

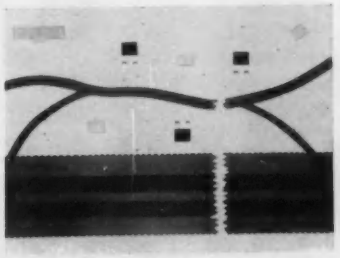

Fig. 3—An existing road can be connected to the highway to provide for shops, etc.

A location such as the interchange shown here could be used for repair facilities

ing the intersection, and those already on the road can swing off, receive service, return to the highway and continue on their way without undue delay.

Existing parallel highways may be used as service roads. Across the bottom of the setup shown in Fig. 3 is the new limited-access highway. A short distance away is the old road, along which service stations, motels, etc., are already located. By connecting the new highway with the existing road at two logical points, the motorist is permitted to turn off, refuel, or stop for whatever else he needs and then return to the main road. Traffic flow is not interfered with, and adequate service facilities of all types are provided without the necessity of large-scale relocation and disruption of existing business.

New methods of obtaining help for stalled motorists will have to be worked out. Public telephones along the highway will no doubt be necessary. Radio-equipped police cars can be counted upon, particularly in the case of cars damaged by collisions. Radio-telephones for passenger cars are coming into use. They should be a most practical method of summoning help.

Preventive maintenance will be more important than ever. With the longer trips made possible by better driving conditions, components should be repaired or replaced before they approach too closely the end of their useful life. It is far more satisfactory and economical to reline brakes, clean the cooling system, renew distributor breaker points, etc., while the car is not in use than to have it tied up when every minute of lost time may represent a mile of travel.

The actual repair shops will not be different, to any great extent, from the facilities which are found along our present highways. Lower passenger cars will call for quick, efficient equipment for lifting of the vehicle when necessary, as new designs are leaving less and less ground clearance. Improved testers for electrical systems, carburetors, fuel injection components, brakes, and front ends will be necessary because of the higher speeds and better all-around performance which will be demanded on the superhighways of tomorrow.

ILLUSTRATION CREDITS

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64—(top) Detroit Dept. of Public Works, (lower) Fairchild Aerial Surveys, Inc.
65—Fairchild Aerial Surveys, Inc.
66 & 67—Calif. Division of Highways
68—Howard, Needles, Tammen & Bergendoff
77—National Street & Traffic Safety Lighting Bureau
79—California Division of Highways
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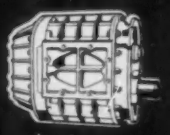

AT THE S. A. E.
1957 ANNUAL MEETING

SCHWITZER
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INDIANAPOLIS, INDIANA

Observations

By Joseph Geschelin

Tail Fins

Cadillac started it many years ago, and 1957 cars of all makes—with only a single exception—have fin-shaped rear fenders. We recall that Cadillac was criticized for using tail fins, and some time ago the rumor was spread that the company would abandon them. Our hope is that no one will take seriously the suggestion of a speaker at the American Chemical Society meeting who predicted that eventually the car would present the appearance of a gigantic fin, tapering to a tiny front end and consisting mainly of an enormous tail light.

Ceramic Tooling

Ceramic tooling has come in for considerable publicity during the past year. Successful applications promise such enormous improvements in cutting speed and surface finish as to excite the imagination. We have tried repeatedly to find production applications without much success to date. It is doubtless true that every manufacturing plant—at least of large size—has been testing ceramics. But it is just as apparent that these attempts still are classified as being experimental. We are convinced that ceramics are destined to make their mark in cutting the hard-to-machine materials. It will take time and effort not only to find the right applications but to determine the best cutting conditions and ceramic tool materials. We would be delighted to record the results of actual production applications as we hear about them.

Quality Control

A number of the larger automobile producers are campaigning for better quality control of the finished product. The occasional car that comes through with annoying defects is the one that causes trouble for the dealer and manufacturer. Too frequently the dealer may not know how to make the repair and sometimes does not care. It is recognized that this has become a serious management problem, one that requires close cooperation between management and the workers. Recognition of the problem and prompt action to do something about it should go far to cement better customer relations.

Six Bores

Oldsmobile has come up with a new wrinkle in carburetion—a combination of three, two-barrel carburetors. The two center barrels will handle the engine right up to road speeds of about 70 mph. The others come in only when the throttle is approaching wide open. The arrangement not only is most efficient for all kinds of driving, it also provides a big boost in horsepower when all six barrels are in action.

Fuel Injection

Here is a subject that will have constant attention until we know more about it. Each engine builder will have problems of installation and arrangement for best performance. The major roadblock, however, remains the matter of price. At this writing the price is so high we hesitate to name it.

The petroleum industry supplied enough fuel and power in 1955 to supply the petroleum needs of the Gay Nineties for 50 years.

•

Each year American farmers invest some $1.5 billion in tractors, machinery, and farm equipment, nearly $1 billion in automobiles and trucks; plus another $2.5 billion for the operation and maintenance of this equipment.

•

In the past 11 years, almost 51 million cars have been built; in the 42 years from 1900 through 1941, a total of 73 million cars was made. Five million automobiles have been built in a single year six times since 1945.

•

A single tankship load of gasoline would run a car for 500 years.

Authorities have estimated that the nation's oil men must discover at least 70 billion barrels of new oil in the next 20 years. This is as much oil as they found from 1859 to 1950.

•

Peacetime military jet fuel requirements for the current year have been estimated at the staggering total of 10 million gal daily.

•

At least 10.5 million gal of hydraulic brake fluid were produced in 1955 to service the nation's more than 51 million automobiles, trucks, and buses.

•

The jig used in construction of wings for a modern transport is so large that workers using the tool must communicate by telephone.

•

The electronic bombing-navigation system of a single jet bomber weighs 1457 lb—almost twice the 750-lb weight of the Wright Brothers airplane.

•

Privately owned aircraft in the U. S. in 1955 consumed 176.6 million gal of gasoline—enough to supply 221,000 average automobiles for one year.

(*Turn to page* 124, *please*)

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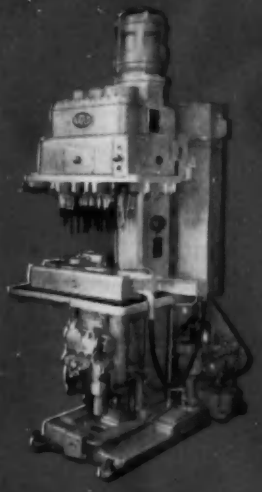

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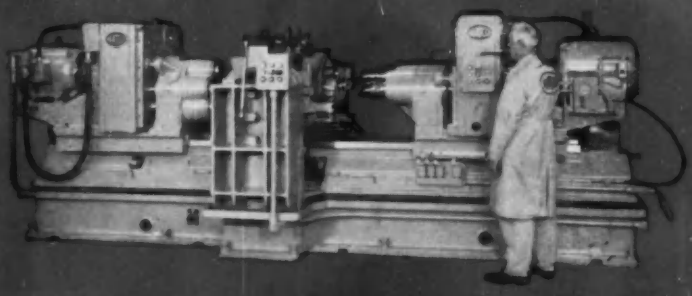

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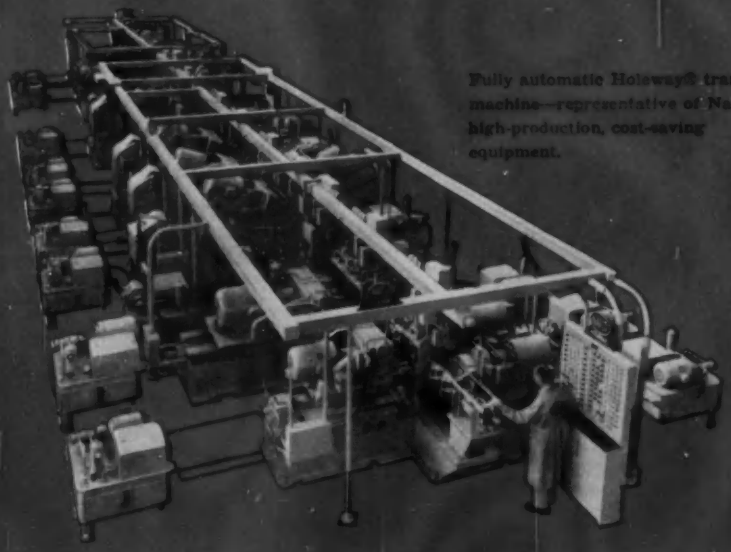

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METALS

Steel Output at Record High with No Dent in Backlog of Orders. New Nickel Mine Expected to Bring in 30,000 Tons a Year

By William F. Boericke

Heavy Demand for Steel Plates

By mid-November the steel industry had chalked up the largest consecutive run of above-capacity output for four years, totalling eight weeks over 100 per cent capacity. This is at the phenomenal indicated rate of 130 million tons a year. October was the first month in which steel production reached 11 million tons. Yet new business entered on the books keeps ahead of shipments, with no dent in backlogs, particularly for heavy steel products. Commenting on steel plate, the president of Lukens Steel asserted that the market for heavier-gage plate will be tight through 1957 at least and is expected to remain so for at least the next five years. Even if the steel industry were to start at once on an expansion program to relieve this situation, no further increase in production for this product can be seen in less than 18 to 24 months.

Much the same can be said for structurals and pipe which are in heavy demand. The shortage has generated new calls for Government controls on distribution but it's unlikely they will get very far at Washington. In spite of the crisis at Suez, domestic consumers refuse to become stampeded and this is particularly true for cold rolled sheets and strip which appear to be in comfortable supply. Automobile plants are buying cautiously pending a closer look at the public's reaction to the new car models. *Iron Age* notes that steel demand from Detroit plants has been held back because of production delays in model changeovers, hesitancy to load up distributors, and willingness to let the mills act as their warehouses for steel. But automotive orders are steadily increasing and lighter grades of steel could well tighten up.

A Cautionary Note for Structurals

A note of caution is sounded, however, in an announcement by the American Institute of Steel Construction that new contracts for structural steel declined in September for the fifth month in a row and were the smallest since Febuary, 1955. Steel producers are inclined to shrug off the implication that business will decline for structurals. They point out that bookings are still running ahead of shipments, and believe that tight money may have temporarily tabled some scheduled expansion plans.

Higher Prices for Steel Demanded

Higher production and material costs are causing more and more steel executives to ask for higher prices for steel. At trade gatherings no secret is made that profit margins are unsatisfactory. Nevertheless, no steel company appears willing to disturb the price pattern set by U. S. Steel. But there is some possibility that a wage increase that will follow any increase of the cost of living index in January would result in a price hike for steel, and most companies might take advantage of "extra" charges to raise their prices as well. Higher costs for scrap and for coal, along with anticipated higher freight rates, give steel producers plenty of ammunition in calling for more money for their products.

Scrap Market Strong

Scrap prices reacted strongly to the muddled Suez situation and steel mills hastened to build up inventories. The *Iron Age* composite price for steel scrap climbed to an all-time high. Seasonal influences contributed to the market strength. It appears unlikely that scrap prices will decline as the flow of iron ore dries up from upper Great Lake ports and from Seven Islands when winter sets in.

No Stockpiling of Nickel In Fourth Quarter

Easing of the current nickel shortage appears to be indicated by the announcement of the Office of Defense Mobilization that the Government will take no nickel for the stockpile in the first quarter of 1957 and that stockpile buying may not be resumed. The ODM diverted to private industry another 5 million lb of the metal originally scheduled for the stockpile for the fourth quarter. This brings diversions for this quarter to 25 million lb and for the year to 79 million lb.

Recognizing the tight situation in nickel, the Government had announced it would pay premium prices, give fast amortization for tax purposes and make purchase contracts as an incentive to develop nickel supplies. As a result, there appears to be an added supply on the way, but progress will necessarily be slow. It has been estimated that if supplies of nickel were adequate, steel production alone would require more than 77,000 tons of newly-mined nickel this year, while other industries could use a further 88,000 tons

(*Turn to page* 126, *please*)

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New Developments Disclosed at Vickers Hydraulic Conference

By Joseph Geschelin

THE 1956 Transport Aircraft Hydraulic Conference, held in Detroit November 13 and 14 under the sponsorship of Vickers, Inc., attracted an and foreign airlines, major airframe producers, and impressive attendance of representative of domestic suppliers.

A. R. Civitate of Vickers sounded the conference keynote in his paper on service engineering facilities and training programs for the users. He said in effect that the upgrading of engineering as well as design, and performance, and durability of program stem from constructive criticism followed by technical service investigation. And that was in general the pattern of the meeting. As a matter of fact, your editor has felt for a long time that a similar kind of meeting of fleet operators and vehicle manufacturers would be just as productive.

The meeting covered about the same ground as previous ones—fixed displacement pumps and motors, variable displacement pumps, valves, seals, hydraulic fluids, hose, tubing, fittings, and other items. One fact stands out from all the discussions: none of these products is trouble free; however many of the hydraulic elements under discussion are doing very well with in the limits of life expectancy. Despite continuing research and quality control vexing problems recur. Some of these can be corrected immediately through concerted effort, others take more time.

Oil seals and O-rings have been improved by the use of such materials as Teflon and the latest types of Enjay butyl formulations. Nevertheless, there is still a need for rubber seal materials capable of coping with higher ranges of temperature. Monsanto reported on a new synthetic seal material, Vynam, which has been used in machine tool hydraulic systems where it has given good service results with a variety of fluids.

Vickers has conducted some highly successful experimental work with ductile iron for its cylinder blocks. The material has shown unusual wear properties and may be the answer to the present problem of wear in the critical block area.

Hydraulic fluids again were subjected to critical appraisal. Some operators of commercial aircraft are planning to use synthetic fluids, many others say they intend to stay with mineral oils. An interesting sidelight is that the newer synthetic fluids being designed for the larger aircraft of the future, the so-called high temperature fluids, are not classed as fire-resistant fluids.

Among the papers dealing with advanced developments, one by W. W. McKenzie, Canadair, Ltd., described the hydraulic system of the Canadair CL-28 Maritime Reconnaisance Aircraft which is due for service in 1957. Although much of the detail of the aircraft is still restricted, details of the hydraulic system were authorized for release.

Hydraulic fluids are so much a part of an airplane that F. H. Langenfeld, Monsanto Chemical Co., urged that it be considered a technical component of the whole rather than simply as an expendable fluid. Describing the steps that are taken in designing a fluid for the giant air transports of tomorrow, he emphasized that work of chemical researchers, experimenters, and field servicemen is related to that of designers and manufacturers of aircraft components.

In discussing the development of synthetic fluids for high temperature operation, Langenfeld summarized the following requirements and objectives:

Adequate viscosity range.
Sufficiently fire resistant.
Chemical stability.
Non-corrosive to aircraft materials.
Non-volatile.
Low order of compressibility.
Non-foaming.
Shear stable as possible.
Safe to handle.
Good lubricant.
Good heat conductor.
Non-conductor of electricity.
Compatible with construction materials.
Long service life.
Capable of reclaiming within limits.

A team of Vickers engineers collaborated on a paper presented by F. Moncher touching on a variety of new developments that will be made available in the near future. One of the most striking is a jet engine starter package consisting of a 70-hp McCulloch engine driving a variable pump; the power output is through a fixed stroke hydraulic motor. The unit is said to be lighter and smaller than competitive electrical or mechanical systems. Besides serving as a starter, it can be employed for hydraulic power generation by converting the hydraulic motor to a variable displacement pump.

Vickers also has developed jet engine controls in

(*Turn to page* 126, *please*)

USING

DU PONT ELASTOMERS

neoprene · Hypalon®

in design

Convertible tops coated with Du Pont Hypalon® resist sunlight, weathering, discoloration, cracking

14 YEARS' EXPERIENCE PROVES

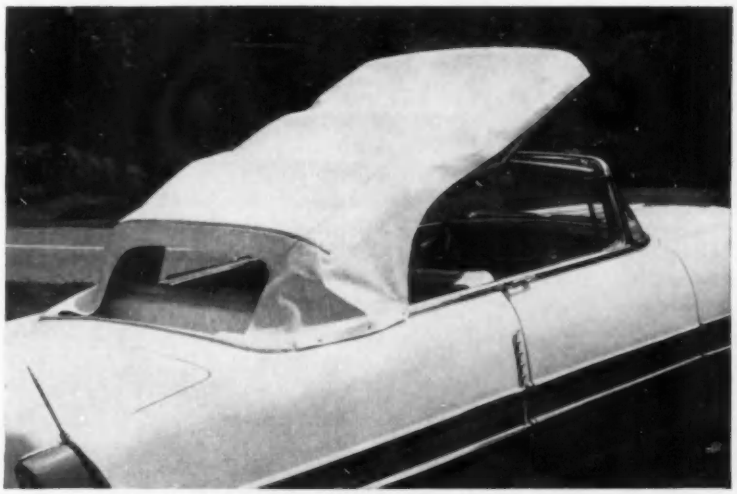
NEOPRENE blocks promote clutch-plate efficiency

For over fourteen years, taxi and truck fleets have been road-testing a new type of replacement clutch plate—one in which resilient blocks of neoprene have replaced conventional metal springs. Results indicate a vast improvement in over-all clutch performance, and maintenance costs have been reduced nearly 50%.

In operation, the neoprene blocks smoothly transmit the torsional force of the clutch. They retain their elasticity for longer than the life of the clutch facing, despite constant flexing and exposure to heat and oil. And cab drivers report there's less lost motion in the drive line—no clutch "chatter"; no trouble with springs breaking or coming loose. The result is more efficient clutch operation and reduced abuse of clutch facings.

It's an outstanding example of design improvement made possible with neoprene, Du Pont's synthetic rubber. Why not see how you can use Du Pont's neoprene to help solve *your* problems? Just clip the coupon for full information.

Small as they are, these neoprene blocks do a big job as replacements for conventional metal springs. Clutch operation is smoother, quieter, more efficient.



Coating of **HYPALON** stays flexible in cold weather, washes easily with soap and water.

Longer service life. There are many reasons for coating convertible tops with HYPALON, Du Pont's new synthetic rubber. HYPALON coatings stay flexible at low temperatures, and they will not crack after prolonged exposure to all kinds of weather. They possess exceptional resistance to sunlight. And they can be compounded in an unlimited range of light-stable colors.

Soap-and-water maintenance. HYPALON coatings also have superior resistance to soiling. They are inherently resilient and do not develop a sticky surface to hold dirt and dust. If HYPALON coatings do become dirty, they can be washed easily with soap and water with no harmful effects.

Manufacturing Advantage. Many other materials wrinkle and crease permanently when folded, but HYPALON synthetic rubber coatings return more readily to their original smooth surface. The HYPALON-coated convertible top also tailors and trims better in manufacture.

Investigate HYPALON. HYPALON is being used by the automotive industry in other items such as spark-plug boots, door stripping and white side-walled tires. Its exceptionally high resistance to ozone, heat, chemicals and outdoor exposure offers still more automotive design possibilities. Just clip the coupon below for more information on the properties of HYPALON.

DU PONT

REG. U.S. PAT. OFF.

HYPALON *is a registered trademark of E. I. du Pont de Nemours & Co. (Inc.)*

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

☐ I am particularly interested in _____

☐ Please add my name to the mailing list for your free publications, "The Neoprene Notebook" and "Facts about HYPALON."

E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, Dept. AI-12
Wilmington 98, Delaware

Name _____ *Position* _____
Firm _____
Address _____
City _____ *State* _____

AUTOMATION NEWS REPORT

AUTOMATIC CONTROLS
PRODUCTION—VEHICES—AIRCRAFT

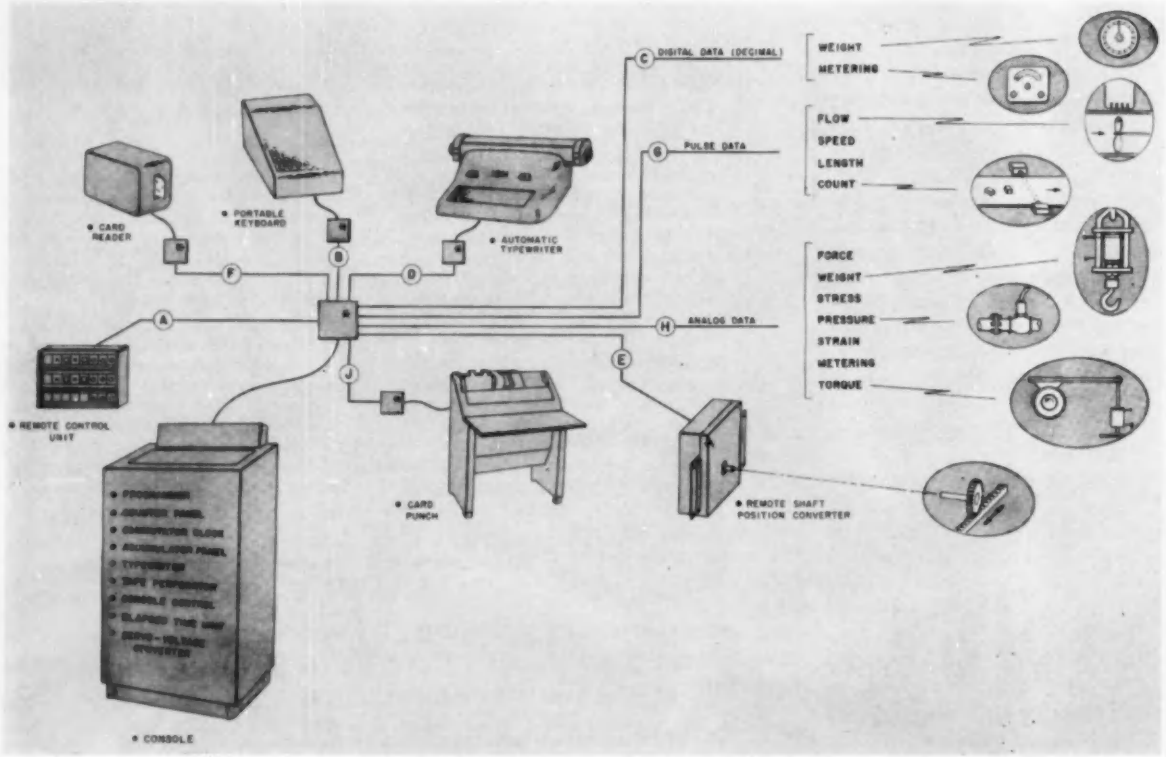
By Samuel Cummings

INTERNATIONAL Business Machines Corp. recently unveiled three new electronic data handling machines designed to bring more automation to factories and offices. The 305 RAMAC and 650 RAMAC (Random Access Memory Accounting) are continuous accounting machines that receive and process data continuously, instead of in periodic batches. The third device, which IBM calls Automatic Production Recording System (APR), is designed for use at the factory to collect production data.

Both RAMAC systems are built around IBM's new random access memory, a storage device from which any bit of information can be extracted in less than a second. The memory unit consists of 50 rotating metal disks, vertically stacked like the records in a juke box, with a storage capacity of from 5 to 6 million digits. Information is recorded on both sides of each disc, which are coated with a magnetically sensitive material. An electronically controlled access arm moves up and down and between the records to dig out any piece of information without scanning through intervening records.

The RAMAC machines are the first in a new line of IBM equipment designed for high-volume, in-line processing of business data. The 650 RAMAC includes an IBM 650 medium-sized digital computer which stores both data processing instructions—the programmed information that moves the access arm—and the data to be processed. Up to four random access memory units, with a total storage capacity of 24 million digits, can be connected to the 650 computer. Typewriter operators at as many as 10 remote input

(*Turn to page* 134, *please*)



Schematic shows operation of new IBM Automatic Production Recording System (APR), which is designed to collect, store, correlate and record data automatically. Modular design of system permits "building block" grouping of components.

MORE THAN HALF.*

Of the 12,172,244 passenger car engines produced in the U.S. from January 1, 1955 through September 29, 1956, more than half were equipped with the new

PERFECT CIRCLE

type "98" chrome oil ring

"Best for New Engines... Essential for Worn Engines"

*53.6% were Perfect Circle Type "98" chrome oil rings. 46.4% were all other oil ring types combined, including other Perfect Circle oil ring types.

ON OUR WASHINGTON WIRE

Government economists are highly optimistic about the market for automobiles in 1957. They say that a sales increase of 10 to 15 per cent is conservative, and if credit does not get too tight next year, sales should boom.

New legislative assistance to small business in 1957 seems assured. The problem for Congress now is how to do it.

Defense spending in 1957 will nudge ahead—perhaps by as much as $2 billion—of the $36 billion annual rate set in 1956. The increase is being brought on by costlier and more complicated weapons and higher price tags.

Fate of fast tax amortization to encourage expansion of defense capacity will probably be decided in 1957. Pressures are on for complete repeal, limiting its application by varying degrees, and to expand it or make it a permanent part of the nation's tax structure.

Automobile manufacturers are prepared to push for reduction in 1957 of the 10 per cent Federal excise tax levied on all passenger cars. If sales of 1957 models are at boom levels, the car makers won't push too hard for reduction. Any serious lag will trigger an intensive appeal to Congress to roll back the tax to the pre-Korea rate of eight per cent.

This country keeps its lead in the number of vehicles being driven, especially where passenger cars are concerned. Latest Commerce Dept. figures show the U. S. with more than 52 million cars, out of a world total of 73 million.

Management of all types of transportation matters for the military forces has now become the responsibility of the Army. Excluded are the ocean carrier functions of the Military Sea Transport Service.

National income was at a seasonally adjusted annual rate of $338.5 billion in the second quarter of 1956. It was up almost $4 billion or one per cent from the first quarter, Commerce Dept. reports.

Hardened and Ground Parts are our *Specialty*

This king pin is truly king-size: 8" long and weighs about 12 lbs. We machined it out of No. 3140-2⅞" bar steel. After heat treating, bearing surface was given the specified fine finish-grind to 2½" dia., +.000 —.001.

Parts like this are our specialty —we've been making them exclusively for the automobile industry for more than 40 years. Each year has added to our knowledge and skill in precise machining, scientifically-controlled heat treating and micro-finish grinding. Let us show you what we can do with one of your tough jobs. Write or wire.

Henry W. Brown
PRESIDENT

Experienced production on:
King Pins • Wheel Studs
Shackle Bolts • Shackle Pins
Brake Anchor Bolts
Countershafts • Idler Shafts
Stub Axle Shafts
Steering Ball Bolts
5th-Wheel Rocker Shafts
Water Pump Shafts
... anything in the hardened and ground line, of any analysis steel, up to 4¼" diameter.

THE BROWN CORP.

213 BELLEVUE AVE. SYRACUSE, N. Y.

C. H. Ehlert, 3407 Clarendon Rd., Cleveland • N. F. Spring, 4716 Balfour Rd., Detroit • R. C. Sanderson, 2342 N. Cicero Ave., Chicago • Harry J. Windmiller, 1704 Carlton, Fort Worth • Lyle M. Johnson, 1355 Westwood Blvd., Los Angeles, Calif. • John B. Hunt, 9811 S.E. Yamhill St., Portland, Ore.

One TOOL DOES THE WORK OF Two!

CP Air-Saw CUTS and FILES...

Stainless Steel, Nickel, Copper, Aluminum, Iron, Steel, Brass, Plastics, Plexiglass, Fiberglas, Porcelain, Formica, Corrugated Transite Sheeting, Wood, Plywood, Hard Fibre, Wall Board, Masonite.

Use it as a saw or a file on heavy-duty production line work. Fit it with a blade and it becomes a utility saw capable of cutting practically every material and every possible shape . . . steel blade stock from your all-purpose band saw can be used for special applications. Add a file chuck and use it with round or flat shank files. Conversion takes 60 seconds. Designed with Variable Speed Control, its cutting action can be regulated to suit your work conditions. For details, write *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, New York.*

Examples of its thousand-and-one uses

1. **In Receiving and Shipping** — opening wooden boxes and crates.
2. **In the Shop** — cutting thin gauge metal without warpage.
3. **In the Foundry** — deburring castings.
4. **In the Autometive field** — installing car heaters, radios and "extra" items.
5. **In the Electrical field** — armature undercutting, cutting coils out of electric motors, filing burrs from stator slots.
6. **In Plant Maintenance** — blind sawing in duct and piping work.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

A BETTER METHOD OF MACHINING

WARHEADS* **THAT EXPLODED AN OLD THEORY••••**

...that all castings had to be big, thick and sometimes cumbersome... had to undergo heavy machining and finishing to even approach accuracy of specfication.

Not so today! The Warheads* are another interesting example of how Albion's resin *shell casting* process has eliminated much of the casting-finishing cost... and, permitted broader utilization of ferritic and pearlitic malleable irons.

As an example, both the castings above appear to be the same *on the outside*... and both are of the same material. Yet, one is far lighter, thinner-walled and accurate... requiring far less machining, finishing time. Another positive proof that Albion's *resin shell* casting process permits closer tolerances, less excess metal—resulting in savings from the laboratory through finishing.

Albion's ferritic and pearlitic malleable irons can be cast to your exacting specifications with physical properties to suit your needs.

Make malleable iron, the versatile metal, a part of your product. Contact your Albion Malleable Iron Company representative today; he will be glad to bring you up-to-date on the rapid development in casting techniques and advantages that can be yours for the asking.

● *Need design or engineering assistance? Albion's competent staff as well as their Research and Development Laboratory are always at your service.*

* 155 MM Projectile Ogive

ALBION MALLEABLE IRON CO. Albion, Michigan

SHORTIES

Employees engaged in the manufacturing of automotive and aircraft equipment now operate over 120 credit unions.

●

Net national product per capita is today approximately four times the figure of 80 years ago, due mainly to a huge (and possible accelerating) rise in productivity per unit of resources used.

●

The aircraft industry spends about 20 per cent of the $3.7 billion total planned by all industries this year for research and development.

●

The average American worker uses $12,500 worth of equipment in his job.

●

The average factory worker's wage today buys 70 per cent more than it did in 1939 and twice as much as in 1930.

●

Improvement in equipment doubles productivity of the average American worker each generation.

●

Every year, a minimum of $40 billion dollars must be saved and invested in private productive facilities to (1) maintain existing equipment, (2) provide facilities for new workers, and (3) provide, conservatively, for a 1.5 per cent per year increase in output per worker.

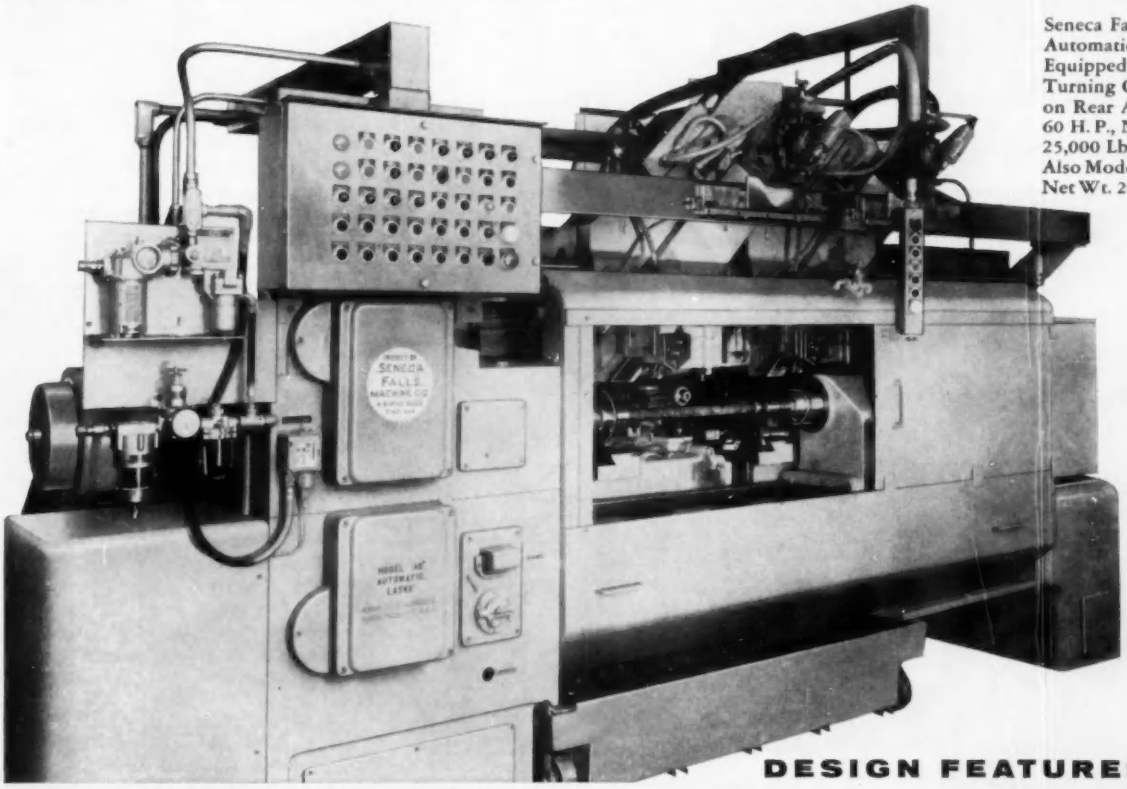
●

Roughly, one out of five privately employed Americans, outside agriculture, is engaged in producing, selling and servicing capital equipment. An equal number is engaged in supporting and supplying industries dependent on the capital goods industries as customers.

●

Every year at least 400,000 new workers join the labor force. Conservatively, it takes $5 billion a year to supply equipment for this legion of youth.

A BETTER METHOD OF MACHINING REAR AXLE, AND OTHER SHAFTS



Seneca Falls Model AQ Automatic Lathe Equipped for Stem End Turning Operation on Rear Axle Shaft. 60 H.P., Net Wt. 25,000 Lbs. Also Model LQ, 30 H.P., Net Wt. 20,000 Lbs.

● The new Models LQ and AQ Seneca Falls Automatic Lathes are designed to combine the best and fastest methods of rough and finish turning shafts on a single machine without removing the work and without attention on the operator's part.

The line drawing shows a machining operation on the stem end of a rear axle shaft which is rough turned with multiple tools on a rear carriage while finish turning is done with single, tracer-controlled tools on each of the two overarm carriages. Thus the advantages of multiple tooling for stock removal and single tool tracer turning for accurate finish operations are combined. By this method extremely close tolerances are maintained since the pressure of the single tool is constant over the entire length of the work piece, and full advantage can be taken of the higher cutting speeds now possible with the newer carbide and oxide tool materials.

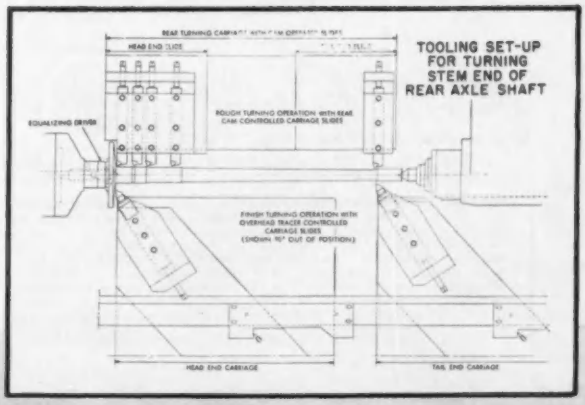
The machining operation is completely automatic . . . the operator loads shafts between centers and pushes the starting button; multiple tools rough turn; tracer tools then finish turn; and finally the machine stops with all tools returned to starting position.

A similar type lathe is used for the flange turning operation. Varying application of multiple tooling or single tracers to either rear or overarm carriages is possible on these lathes and complete "in line" automation can be engineered to specific production requirements,

Seneca Falls Machine Co., Seneca Falls, N. Y. Write for Bulletin Q-56-D

DESIGN FEATURES

- ▶ **Simplified changeover features for reduced set-up time.**
- ▶ **Feed rate may be automatically changed during cutting cycle.**
- ▶ **Streamline design for efficient chip guarding.**
- ▶ **Screw feed to all carriages.**
- ▶ **Four speed head with automatic change-over.**
- ▶ **Large chip flow area.**
- ▶ **All templates clear of chip area.**
- ▶ **All ways hardened, ground and replaceable.**
- ▶ **Open front design facilitates loading and unloading.**
- ▶ **Straight line diameter adjustment for tracer tools . . . no shoulder length change to correct.**


TOOLING SET-UP FOR TURNING STEM END OF REAR AXLE SHAFT
HEAD END SLIDE
EQUALIZING DRIVER
ROUGH TURNING OPERATION WITH REAR CAM CONTROLLED CARRIAGE SLIDES
FINISH TURNING OPERATION WITH OVERHEAD TRACER CONTROLLED CARRIAGE SLIDES
HEAD END CARRIAGE
TAIL END CARRIAGE

NEW SENECA FALLS MODEL LQ AND AQ AUTOMATIC LATHES

Vickers Hydraulic Conference

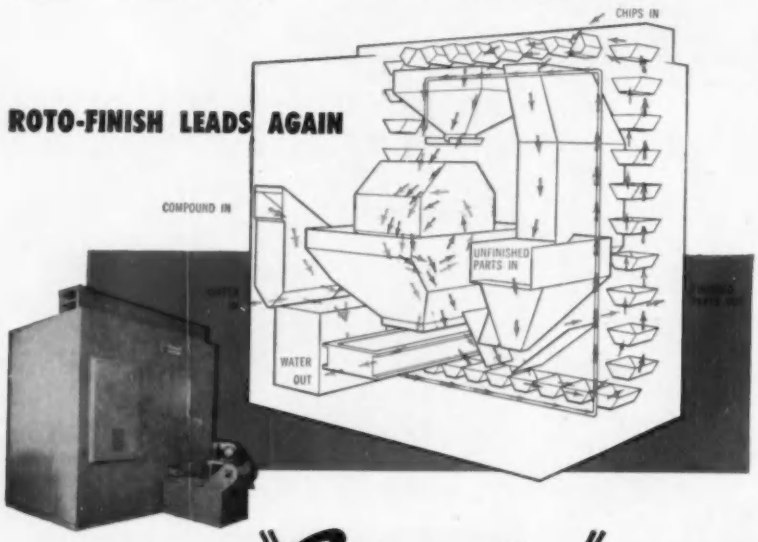
(*Continued from page* 118)

which hydraulic pumps are used for the modulation of the exhaust nozzle area. One of these has been designed for the J-79 engine. Another item is a dynamic test stand for jet engine fuel controls.

A hydraulic package has been developed for aircraft which is not only a complete hydraulic system but incorporates its own prime mover to provide power when the main propulsion engines are not operating.

Among other surprises at the conference were two new pumps. One of these is a contamination tolerant pump that is unaffected by contaminants in the fluid. The other is a "clean" pump which aids in reducing contamination in the hydraulic circuit. In this instance, the pump is relatively free from wear, hence does not introduce wear particles into the system.

ROTO-FINISH LEADS AGAIN



the new "Rotomation" MACHINE

MAKES MECHANICAL TUMBLING A FULLY AUTOMATIC BARREL FINISHING PROCESS

- Completely Automatic
- Needs no operator in attendance
- Loads and unloads itself with each cycle.
- Cycle variable for different part requirements.
- Provides continuous operation
- Assures uniformity of finish
- Low cost operation — high production
- Complete package unit
- Simple to install . . . Electric, water, air and drain connections only.
- Suitable for straight line production.
- Thus, "Rotomation" barrel finishing machine becomes a machine tool.

Roto-Finish COMPANY
3713 MILHAM ROAD, KALAMAZOO, MICH.
P. O. Box 988 — Phone FI 3-5578

ORIGINATORS OF THE ROTO-FINISH PROCESS

FOREIGN REPRESENTATIVES: CANADA — Toronto — Canadian Hansen & Van Winkle Co., Ltd., Cor. Silver and Morrow Aves. ENGLAND — Mark Road — Hemel Hempstead — Hertfordshire — Roto-Finish Ltd. AUSTRALIA — Cheltenham, 89 Tulip St., A. Flavell Ltd. HOLLAND — BELGIUM — LUXEMBURG — Delft, Holland — N.V. Roto-Finish Maatschappij Rotterdamseweg 370A • AUSTRIA, GERMANY, SWITZERLAND, NORWAY, SWEDEN Frankfort a.M. — Metallgesellschaft A.G., Germany — Reuterweg 14 • ITALY — Milan — Societa Roto-Finish a R.L. — Santos S. Giovanni — Viale E. Marelli 31 • FRANCE — Paris Societe Roto-Finish, 40-42 rue Chance Milly — Clichy, (Seine) • BRAZIL — Rio de Janeiro — Commercial E. Industrial de Formos Worco, Ltds. rua General Gurjao, 326 • SPAIN — Barcelona — Instituto Electroquimico, S.A. — Corcega 59.

METALS

(*Continued from page* 116)

for various purposes. This would place total needs at 165,000 tons a year without stockpiling, and amounts to an excess demand of 15,000 tons over a supply of only 150,000 tons.

International Nickel Co. of Canada, which dominates the nickel industry to a much larger degree than U. S. Steel controls the steel market, has made it tolerably clear it will not advance the nickel price for the time being. Yet French consumers have been recently notified by their principal supplier of a rise in price.

Best news for nickel users, even although relief is several years away, is announcement by International Nickel of immediate development of a new mine 400 miles north of Winnepeg, which it is claimed will be the second largest nickel producer in the world. The company will put $150 million into development which will bring in 30,000 tons a year of new production, or about a 20 per cent addition to the present supply. Larger output is expected as well from Cuba and domestic sources.

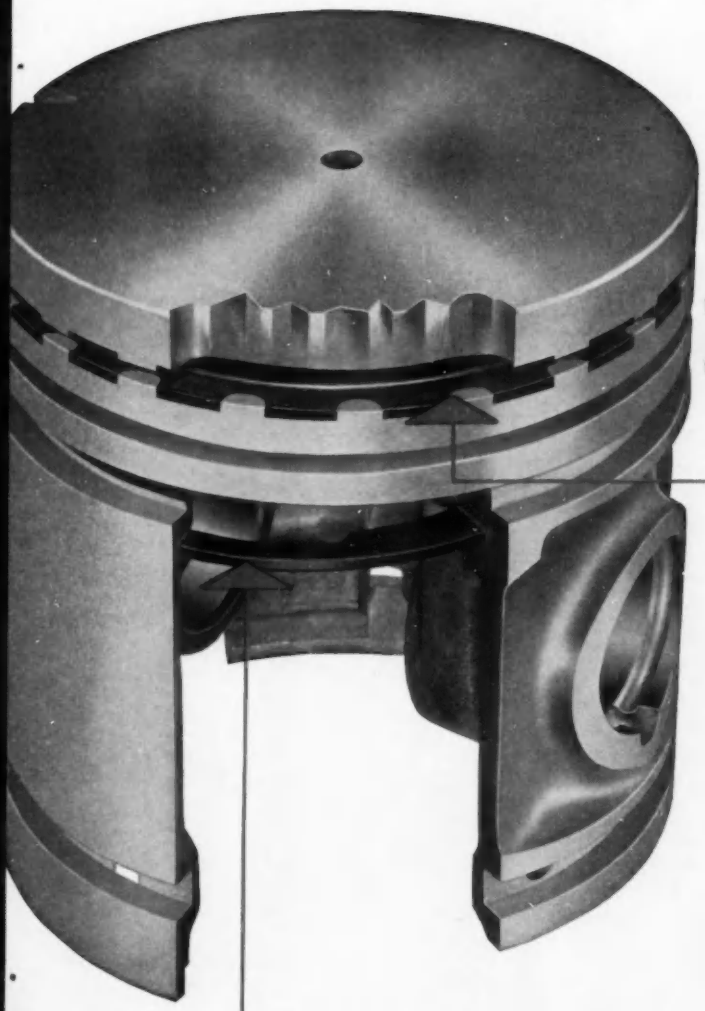
Copper Price Seen Stabilizing

By mid-November it appeared that the copper price would stabilize temporarily at least around 35-36 cents per lb. Following the four-cent cut by the three big domestic producers to 36 cents, custom smelters who had been offering the metal for less advanced to the same level. Katanga, the big Belgian Congo producer, followed suit, and finally the Rhodesian Selection Trust group, which had cut to 33⅛ cents, joined the others. Thus the world price begins to show some semblance of stability in spite of over production and war fears.

No doubt the action of Anaconda and Phelps Dodge in reducing mine production by about 4000 tons a month was a powerful stimulant in strengthening the market. This action which would indicate a cutback of about four per cent in total U. S. mine and smelter output, attacks the root of the present oversupply. However, this production cut, which will likely be followed by similar action on the part of other producers, will have no immediate effect on refined supply for about 90 days, the time required to process concentrates into electrolytic copper.

(*Turn to page* 128, *please*)

NOW! STERLING CONFORMATIC* PISTONS



CONFORMATIC STEEL CONTROL MEMBER, anchored at the pin bosses only, controls skirt clearance . . . hot or cold! The metered steel insert allows you to specify the piston clearance you want for your engine. (Clearances from zero to ½ thousandth inch are generally recommended.)

are available with LOW COST Intra-Cast* STEEL-LINED GROOVES

***Steel protection—top and bottom*—gives sensationally longer life to rings and grooves.**

This ring is *integrally cast* into the piston . . . positioned so that when the grooves are machined, the top ring groove is *lined with steel* and has islands of aluminum for ring cooling. This Intra-Cast steel-protected groove resists enlargement and materially reduces top ring land wear and rounding. And, it does it at far less cost than other methods.

** Tradename Registered*

STERLING ALUMINUM PRODUCTS INC.

ST. LOUIS, MISSOURI

METALS

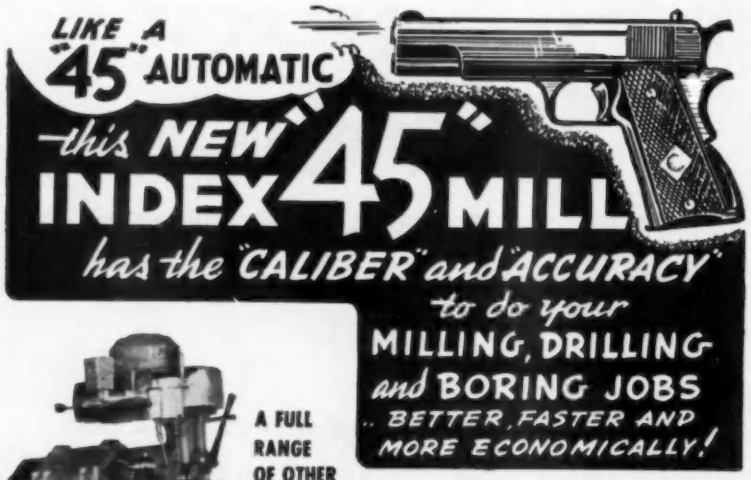
(*Continued from page* 126)

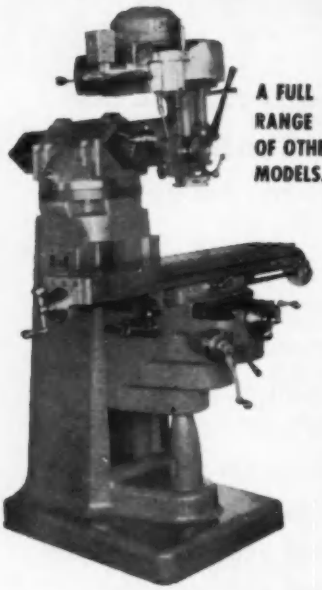
Brass Mills Operating At Reduced Rate

As so often happens in metal markets when price weakness develops, consumers seek the sidelines expecting still lower prices. The movement is generally overdone and the present situation appears to be no exception. Some segments of the copper industry are doing quite well, notably the wire mills and copper tube manufacturers. Other important users, which include the brass mills, are singing the blues. Shipments are down substantially from the first half of the year and mills in the Connecticut Valley are running at 60-70 per cent of capacity. No substantial gain is expected until 1957. Slow demand from Detroit is blamed for the business decline but a lower rate in residential construction is quite as important a factor.

As yet the tension in Suez has had little effect on domestic copper demand, although the volatile London market reflects almost daily concern over war. Stoppage of traffic through the Canal has been used to bid up copper prices abroad but actually very little copper travels through Suez. However, hostilities on a large scale would undoubtedly send copper prices kiting, both abroad and in U. S.

In the meantime domestic mine production, plus net imports, totals about 135,000 tons a month supply of new copper. Shipments have been approximately 116,000 tons. Thus there is an indicated surplus of some 19,000 tons a month. The need to cut back mine production while imports are at so high a figure is obvious.





A FULL RANGE OF OTHER MODELS.

The big caliber derives from the sliding overarm—The unique square design of this overarm gives much more rigidity with its resultant greater accuracy—It provides extra range and capacity—More usable working space—More versatility in set-up—More power at the cutter. No adjustment required on overarm and head after use, and no need to re-indicate head after moving overarm. Speed range with 9 changes makes possible the use of high speed or carbide tipped cutters to the best advantage. Many other important features.

Write for Literature.

INDEX MACHINE CO.

551 N. MECHANIC STREET JACKSON, MICHIGAN

Zinc Shipments Up Aided By Government Buying

Analysis of the zinc statistics for October give some cause for gratification; also some cause for uneasiness. Total sales for the month were 106,848 tons, a new high record for the year. Domestic shipments were nearly 85,000 tons, indicating excellent demand from the galvanizers. All of the balance, 21,392 tons, went to Government accounts; this was about 1/5 the total shipments. Stocks on hand at the end of the month declined 13,300 tons; on the other hand, unfilled orders were less by 11,000 tons. It seems obvious that without Government buying price weakness in Prime Western would have developed. Disappointment over sales of Special High Grade is apparent because of failure of the die-casters to come in the market in a big way.

No doubt the barter deal by the Government to permit sale to the stockpile of foreign zinc that has been brought to this country for refining in exchange for U. S. surplus agricultural products will cut stocks of metal, as shown by the quoted figures of the Zinc Institute. This action lessens the impact of large imports on the domestic market which has had to absorb heavy tonnages from abroad in recent months.

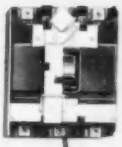
Lead Sales Steady

Demand for lead appears satisfactory, and sales have been steady. London prices have been stronger because of events in the Near East but domestic users have been unconcerned. In London lead sold at about 14.8 cents per lb., which is more attractive to foreign producers than the 16-cent domestic price after tariff and shipping costs. Shipments of replacement batteries in September showed the usual seasonal increase but were somewhat lower than a year ago. Canadian lead production was less than in 1955.

(*Turn to page* 133, *please*)

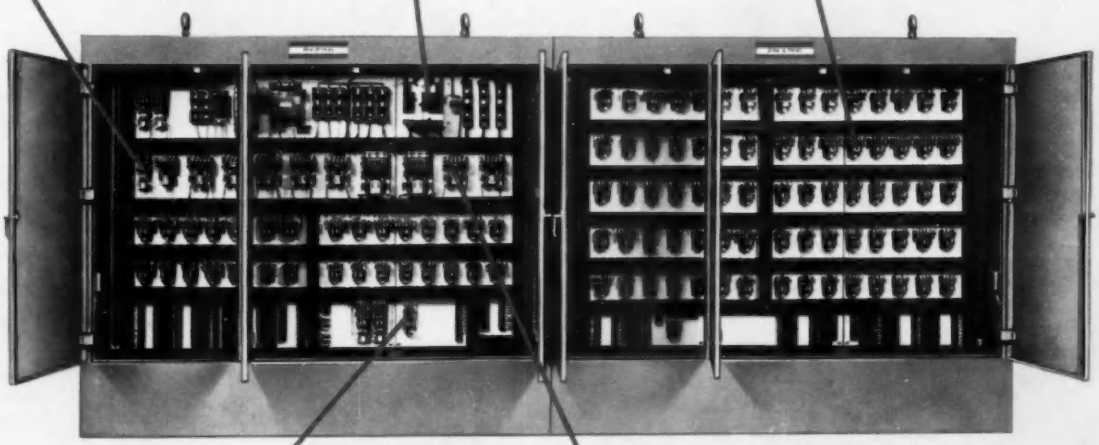
Another Manufacturer Chooses G-E Control For Automotive Industry Machines

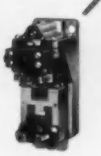
LATCHED-IN RELAY is used where it is important to maintain continuity of sequencing after a power failure.



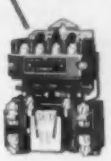
CIRCUIT BREAKER provides maximum short-circuit protection, is electrically interlocked with all panel doors.

6-POLE IN-LINE MACHINE TOOL RELAY has same mounting dimensions as the 4-pole form, provides easy wiring.





PNEUMATIC TIME-DELAY RELAY provides high repetitive accuracy, is easily adjustable from 0.2 to 180 seconds.



MAGNETIC STARTER, with contacts easily inspected from the front, has Strongbox coil for longer electrical life.

Other G-E Devices for JIC Applications

STRONGBOX SOLENOIDS, with coils completely sealed against the entrance of oil, dust, or moisture, are available in a wide range of ratings in both push and pull forms. In addition to five-position mounting versatility, G-E Strongbox solenoids offer longer electrical and mechanical life for JIC applications.

OIL-TIGHT PUSH BUTTONS provide maximum flexibility. The many separable operators are interchangeable and the basic contact block can be mounted singly or in combination. Indicating lights and rings are available in six brilliant colors. Oil-tight push buttons are furnished in stations or for panel mounting.

New General Electric Panel Controls Engine-block Machine

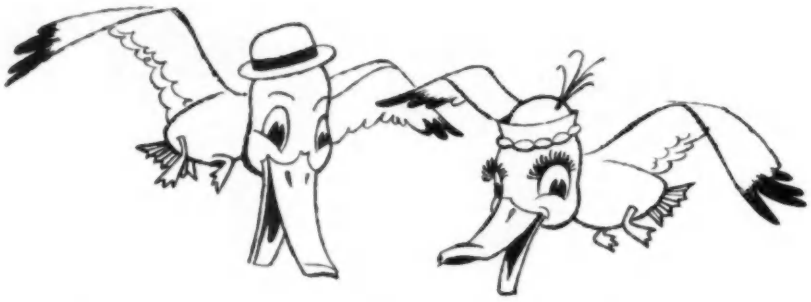
The General Electric Pan-A-trol* panel shown above is one of several recently completed for a major machine tool company. The machine which this panel controls will be used on the engine line of a leading automotive manufacturer.

Designed for high speed production, the machine will bore, turn, face and chamfer cylinder blocks—all automatically.

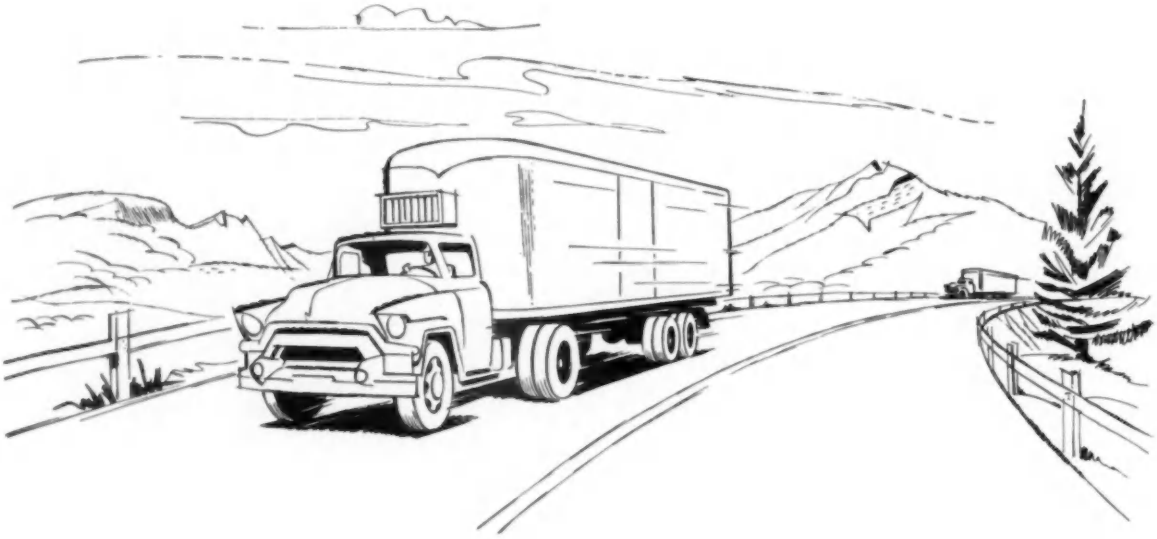
For highly reliable control on machines like this—and other machines in your plant—specify General Electric. Your G-E Apparatus Sales Office or Distributor can give you complete information on all G-E control devices, or write for Bulletin GEA-6317—CONTROL DEVICES FOR JIC STANDARDS—to Advertising Section 733-19, General Electric Company, Bloomington, Illinois.

*Trade-mark of General Electric Company

GENERAL ELECTRIC



They are also birds of a feather ...all have SKF® bearings



By flocking to a single source where all basic types of bearings are available, many in the automotive industry are fast becoming "birds of a feather."

They share a common knowledge that **SKF**'s complete line provides a bearing with *plus values* for every application.

Why not profit by their experience, and wing your way towards **SKF**, today. 7752

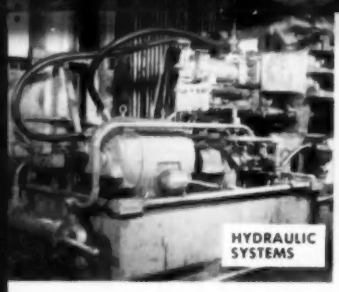
SKF

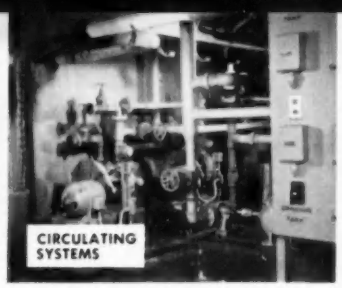
EVERY TYPE—EVERY USE

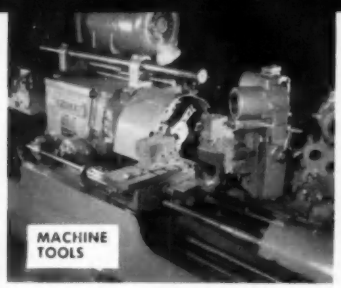
- *Ball Bearings*
- *Cylindrical Roller Bearings*
- *Spherical Roller Bearings*
- *Tapered Roller Bearings ("Tyson")*

*Reg. U.S. Pat. Off. Tyson Bearing Corporation

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.



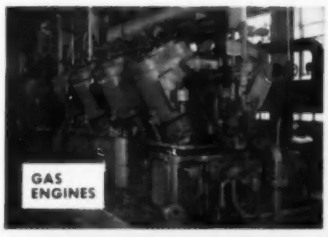


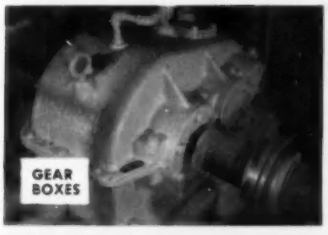


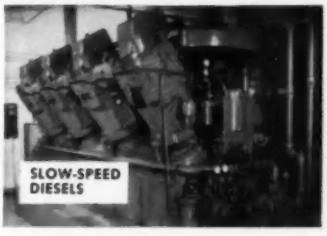
SUN SOLNUS OILS IDEAL LUBRICANTS FOR 80% OF ALL APPLICATIONS

Moderately priced...low in carbon-forming tendencies, Sun Solnus® oils simplify your storage problems by doing with *one oil* many jobs that would otherwise require *several.* Their ability to protect metal parts against corrosion, their resistance to oxidation, and their moderate price all add up to "more lubrication per dollar."

For technical information, see your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-51.







SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

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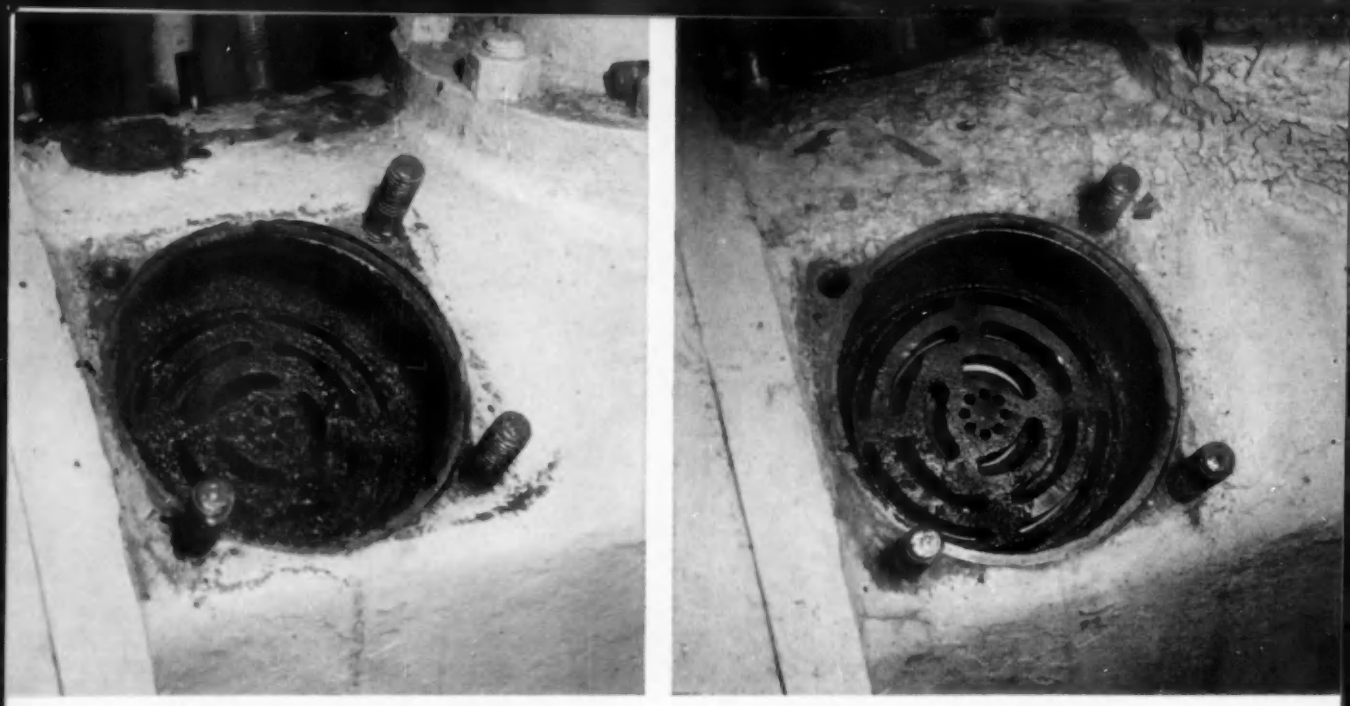
In Canada: SUN OIL COMPANY LIMITED, Toronto and Montreal



Valve on left is from compressor run for 3,000 hours with well-known, high-grade oil. At right is same valve after a 3,000-hour run with Sun Solnus oil. Note difference in carbon deposits.

3000-HOUR TEST PROVES SUN SOLNUS OILS REDUCE CARBON BUILD-UP IN COMPRESSORS

Equipment: A three-stage Norwalk horizontal-type compressor. Operating pressure: from 1,000 to 1,500 psi.

Test: The compressor was cleaned thoroughly and filled with a well-known, high-grade oil. The equipment was run for 3,000 hours, then torn down for inspection and cleaning. Then Solnus® 300 was tested in the same way.

Results: Look at the two pictures. You can see for yourself how Solnus oil reduced dangerous carbon build-up.

All types of reciprocating air compressors that have been changed over to a Sun Solnus oil show similar results. A test in your compressor will show the same remarkable reduction of carbon deposits.

You can get a technical bulletin about Sun Solnus oils by asking your Sun representative, or write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-52.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

© SUN OIL CO.

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

METALS

(*Continued from page* 128)

Ample Aluminum Available

Secondary aluminum prices continue to decline. By mid-November dealers were quoting 23½ cents for No. 12 alloy and 26½ cents for No. 13 alloy. The easier price reflects a generally good supply of both primary and secondary metal, particularly the latter. Confirming the belief that aluminum is no longer in the scarce list was frank admission by the president of the Aluminum Company that productive capacity may have temporarily gone ahead of demand for the metal. In consequence the industry is embarking on an intensive sales campaign to expand use. Demand in the second and third quarters was not up as much as expected, and was less than in the first quarter. Nevertheless, the demand next year is expected to be more than in 1956. Substantial increases are expected in automobile manufacturers' use of aluminum, as well as in packaging, residential building and telephone cables. By 1958 aluminum consumption should exceed 3 million tons a year, and be substantially more than present output.

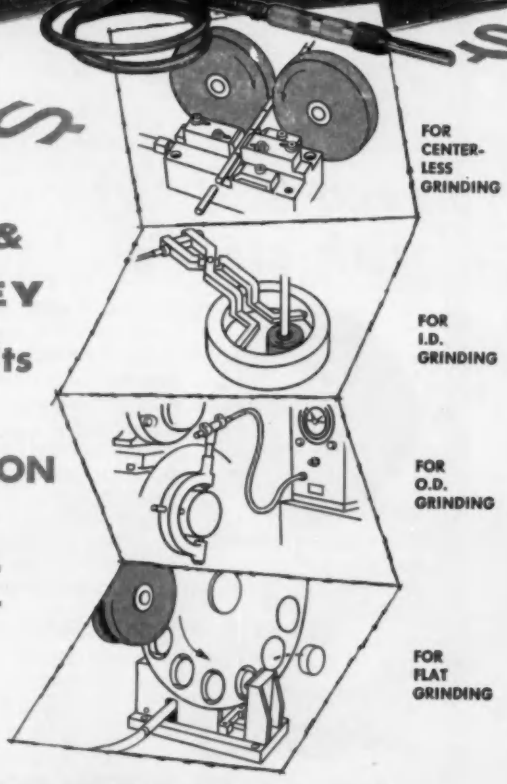
BOOKS . . .

ELEVATED-TEMPERATURE PROPERTIES OF COPPER AND COPPER-BASE ALLOYS, *published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price, $5.50.* This is another in the current series of reports prepared under the auspices of the Data and Publications Panel of the ASTM-ASME Joint Committee on the Effects of Temperature on the Properties of Metal. In this summary, data for the coppers are limited to wrought materials, and for the alloys, apply to both cast and wrought materials. Graphical data includes modulus of elasticity, tensile strength, yield strength, reduction of area, elongation, stress for creep rates of 0.00000, 0.00001, and 0.0001 per cent, and stresses for rupture in 100, 1000, 10,000 and 100,000 hr.

PROCEDINGS TWELFTH ANNUAL MEETING METAL POWDER ASSOCIATION, *published by Metal Powder Association, 130 West 42 Street, New York 36, N. Y. Price, $3.00.* This publication includes technical papers presented at the 1956 Annual Metal Powder Meeting, which was devoted to advances in all fields of powder metallurgy. Papers included are: "Age Hardenable Brass Alloys Through Powder Metallurgy"; "Use of Sintered Metal Part in IBM Products"; "Replacement of Castings by Powder Metallurgy"; "Application of Powder Metallurgy in Nuclear Engineering"; and "Powder Metallurgy in the Electrical and Electronics Industries."

There's "Jack" in this BOX!

PRATT & WHITNEY control units provide AUTOMATION the EASY, LOW-COST way



Increased production . . . reduced reject losses . . . greater accuracy! These are the profitable advantages you get through Automatic In-Process Gaging. And now, *standard, on-the-shelf* Pratt & Whitney Control Units . . . plus a minimum of special gaging fixtures . . . can give you an in-process gaging installation exactly tailored to *your* needs *without* the long delays and heavy expenses involved in engineering and constructing special equipment.

GET FACTS AND FIGURES . . . Prove how P&W Automatic, In-Process Gaging can improve your profit picture . . . how easily it can be applied to your machines. Phone the P&W Branch Office near you and ask a Pratt & Whitney Direct-Factory Gage Specialist to analyze your needs and submit his recommendations.

PRATT & WHITNEY COMPANY
INCORPORATED
18 Charter Oak Boulevard, West Hartford 1, Connecticut
Branch Offices and Stocks in Principal Cities

MACHINE TOOLS • GAGES • CUTTING TOOLS

Automation News Report

(*Continued from page* 120)

and output consoles may deliver data or "ask" the machine for information. Answers will appear seconds later on the typewriter.

In addition to its disk memory unit, the 305 RAMAC contains a magnetic drum for storing working data, a magnetic core immediate access memory for speed, and the control circuits for data handling and arithmetic. Input is through a punched card reader incorporated in the console. An electric typewriter at the remote console can be used to ask the memory for information, as well as to store information. Answers are delivered either on punch cards or through the electric typewriter. Both machines can handle a variety of business data, such as sales, earnings, inventories, accounts receivable, etc.

The APR system picks up information from assembly lines and continuously processes it in a form suitable for quick management action. The system consists of 16 basic components or building blocks which can be assembled in various combinations to handle a wide variety of production data. Components include automatic and manual inputs, pre-punched card readers, printing card punches, control console, and remote typewriters. Heart of system is a programmer which coordinates the flow of information from input and storage elements to output units.

***RAMAC** memory unit consists of 50 magnetic metal disks arranged in vertical stack. Information flows to and from memory through an electronically controlled access arm. Entire stack rotates at 1200 rpm.*

APR can get its data from a variety of commercially available sensing devices, such as strain gages, flowmeters, counters, and voltmeters. It organizes this data, stores it, and either prints it on a typewriter for on-the-spot use or perforates a tape that can be run through a tape-to-card punch machine or transmitted by teletype equipment to a central office. Information can also be fed directly to a data processing machine, which can put out production, cost inventory and other management reports.

Deliveries on both RAMACs are scheduled for some time around the middle of next year. APR units are already in operation on a test basis in several plants. The 305 RAMAC will rent for $3200 a month; monthly rentals for the APR will range from $325 to $1200 or more, depending upon the complexity of the system. The price of the 650 RAMAC will be announced later.

AUTOMOTIVE INDUSTRIES KEEPS YOU INFORMED

for greater safety

recessed turn signal with stop and rear light

KD 766, 766ST Scientifically designed for truck, trailer, bus turn signal, stop and rear lite service. *Non-fading* 4" Lucite lens recessed 5/16" for protection . . . locked in by *removable* galvanized snap ring . . . screw driver relief notch. Mounts flush . . . vibration proof . . . felt pad. Moisture-proofed and dust-proofed by rubber lens gasket and rubber socket insert. One-piece steel body Bonderite-protected . . . baked black enamel. Diameter 5 3/8" . . . depth inside flange 1 11/16" . . . panel opening 4 3/4" . . . three bolt holes on 4 13/16" circle. **KD 766** Turn Signal only . . . Amber or Red lens. **KD 766ST** *Stop and Rear Lite or Combination Turn Signal, Stop and Rear Lite!*

CLASS A TURN SIGNAL SWITCHES
fused for burn out proof operation

KD 722 Unique built-in delayed cancelling action.

KD 720 Manual operation . . . rugged construction for long service.

CLASS A TURN SIGNALS

Streamline Single Face . . . Amber or Red.

KD 768 Two Face . . . Amber or Red . . . slim . . . trim.

KD 769 Flush Mounting . . . Amber or Red . . . heavy duty.

The Complete Line Turn Signals, Stop and Rear Lites, Truck Mirrors, Reflectors, Clearance Marker Lites are representative of K-D's *single-source service.*

K-D LAMP COMPANY
1910 ELM STREET • CINCINNATI 10, OHIO
WAREHOUSES: ATLANTA - BOSTON - CHARLOTTE - CHICAGO
DALLAS - KANSAS CITY - LOS ANGELES - MEMPHIS - MINNEAPOLIS
NEW YORK - PHILADELPHIA - SAN FRANCISCO - SEATTLE - TORONTO

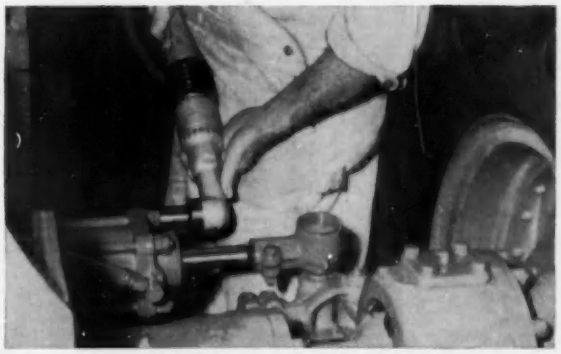
THE COMPLETE LINE • KD • SAFTEE PRODUCTS

Now! Four complete lines!

Thor right angle air tools

Capacity range—No. 12 to ¾" nuts

NEW NO. 4 SERIES SPECIALLY DESIGNED FOR HEAVY DUTY



HEAVY DUTY WORK

Thor's newest entry in the direct drive right angle air tool field is the No. 4 heavy duty series. All new, the No. 4 series offers extra power, light weight and long trouble-free life.

LIGHT DUTY WORK

Lightweight Thor No. 2 series right angle air nut setter makes this assembly job quick, sure and easy on the operator. No. 2 series includes tools up to ¼" capacity—and is available with an offset or lever throttle. Also a wide range of accessories.

All Thor right angle nut setters available in single or double end attachments

You can apply nuts or remove them with any of the tools in the Thor No. 2, 3, 4, and 5 series. Equipped with double end attachments, one end applies nuts—the other removes them.

CLOSE-QUARTER WORK

Getting at those hard-to-work areas is no problem for this Thor right angle nut setter. This tool is from the Thor No. 3 series which includes nut setters up to 5/16" capacity. All Thor nut setters and screwdrivers have built-in air regulators.

Thor PORTABLE POWER TOOLS

Thor's flexibility goes even further. All four right angle tool series, in single and double end, offer a heavy duty attachment and a close quarter attachment—plus a complete range of speeds in all sizes and types. Thor has right angle air tools which can be adapted to most any application involving threaded fasteners. Thor Power Tool Company, Aurora, Illinois.

THOR POWER TOOL COMPANY

Branches in all principal cities

AIRengineering at work
REPORT No. 5098B-3

Multiple Screw Driver assembles 400 carburetors per hour

Assembling carburetors was a slow, one-screw-at-a-time operation until AIR engineering solved the bottleneck. Now one operator uses this 8-spindle automatic Multiple Screw Driver to help turn out more than 6 completed carburetors per minute—400 every hour.

This compact, easy-to-operate Multiple Screw Driver is just one more example of how AIR engineering is helping modern industry solve problems and cut production time and costs.

All the experience of Ingersoll-Rand in speeding up fastening through AIR engineering multiple units is yours for the asking. Whether your operations involve screw-driving or nut running with either hand-held or automatic production line units, Ingersoll-Rand can engineer and build just the unit best suited to your needs.

8-Spindle Multiple Screw Driver for carburetor assembly.

Drop us a line if you'd like an AIR engineer to analyze and make recommendations on your fastening operations.

Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-341

Vehicle Exhaust Gas Still a Problem

Despite investment by the automobile industry of approximately $2½ million for research and development to control motor vehicle exhaust products in relation to air pollution, there still is no satisfactory solution to the problem.

In a progress report to Los Angeles air pollution officials visiting Detroit recently, automobile industry representatives demonstrated induction control devices and exhaust purifiers, both designed to reduce emissions of hydrocarbons. They also reported, however, that none of the devices developed thus far can be recommended to the public as a completely satisfactory solution.

Due to peculiar climatic conditions, the Los Angeles area in particular suffers periodically from eye-smarting "smog." Automotive exhaust emissions are believed to contribute to the situation.

A basic problem confronting the industry task force charged with studying the exhaust gas problem is that previous estimates, which indicated up to 60 per cent of all emissions occur during deceleration, have proved to be in error. Latest data indicate such losses to be in the area of 26 to 30 per cent. As a result, it now is felt that while induction devices may be of some benefit, by far the most important area of control must be through the exhaust system.

The program, now in its third year, has been considered in the "tooling up" phase involving assembling available research data and developing adequate instrumentation. By the end of this year the committee expects to have basic data on hydrocarbons and its instrumentation completed.

The next phase of the program will be actual testing under existing Los Angeles conditions using new instrumentation and statistical procedures to determine the nature of exhaust emissions and at what operative conditions they occur in highest concentration.

It is estimated that induction devices would cost from $5 to $25 per car, and exhaust afterburner or catalytic devices would cost at least that much or more. It is expected, however, that the next attack on the problem will be made through some type of afterburner in the exhaust system, since induction devices would alleviate not more than 15 to 20 per cent of the hydrocarbon emissions at best.

AI TABLOID

(*Continued from page 37*)

Ford Motor Co. will construct a 36,000 sq ft addition to its Green Island, N. Y., plant.

* * *

Westinghouse Electric Corp. has further departmentalized its Transformer Div. by formation of a new Power Transformer Dept.

* * *

Philco Corp. is now producing for the Navy a new air-to-air guided missile known as the "Sidewinder."

* * *

Ray-O-Vac Co. has acquired Mayfair Molded Products Corp. . . . Tecumseh Products Co. has purchased all of the outstanding stock of Taylor Sales Engineering Corp.

* * *

Britain's Hawker Aircraft concern is building a new fighter that reportedly will be capable of 1800-mph speeds.

* * *

National Engineers' Week will be celebrated during the period of Feb. 17 to 23.

* * *

Curtiss-Wright Corp. plans to build a new West Coast plant in North Hollywood, Calif., for the overhaul of aircraft engines.

* * *

Reinforced Plastics Div. of the Society of the Plastics Industry, Inc., has set up an information program presenting the practical significance of new and continuing developments in reinforced plastics to manufacturers, engineers, architects and designers.

* * *

Vac-U-Lift Co. is the new name of the Blakeslee Manufacturing Co.

* * *

General Motors of Canada is building an 80,000 ft extension to its body assembly plant at Oshawa, Ont.

* * *

National Metal Trades Association has inaugurated a new material handling and plant layout advisory service.

(*Turn to page 143, please*)

Have you seen what this CAN DO FOR YOU?

Torque control IMPACTOOL

NEW accuracy and speed for precision nut running jobs . . .

- **POSITIVE TORQUE CONTROL**—a revolutionary use of a rugged steel torsion bar for precision control of torque—combined with the power and speed of the Impactool.
- **SIMPLE TORQUE SETTING**—torsion bar adjusting sleeve is clearly calibrated for changing torque with easy-to-use torque jig.
- **TORQUE SETTING REMAINS CONSTANT**—for any nut running condition until the adjustment is changed.
- **ELIMINATES "OVER-TORQUE"**—impact mechanism rebounds instantly when preset torque is reached, tripping a foolproof rubber faced shutoff valve.
- **LOW MAINTENANCE**—combines many of the proven features of Ingersoll-Rand Impactools, with their enviable record of dependable performance and low maintenance.
- **REVERSIBLE**—full power in either direction.
- **NO CLUTCH**—to wear, slip or require adjustments.

* 2 TORSION BARS PROVIDE MULTIPLE TORQUE SETTINGS

- No. L735 Max. torque 60 ft. lbs.
- No. H735 Max. torque 90 ft. lbs.

For torques up to 550 ft. lbs. a Size 5340T Torque Control Impactool is available.

Get a free demonstration of Ingersoll-Rand Torque Control Impactools by an I-R AIR engineer now... or write for additional information.

Ingersoll-Rand
11 Broadway, New York 4, N. Y.
8-342 IMPACTOOL DIVISION

National Automobile Show

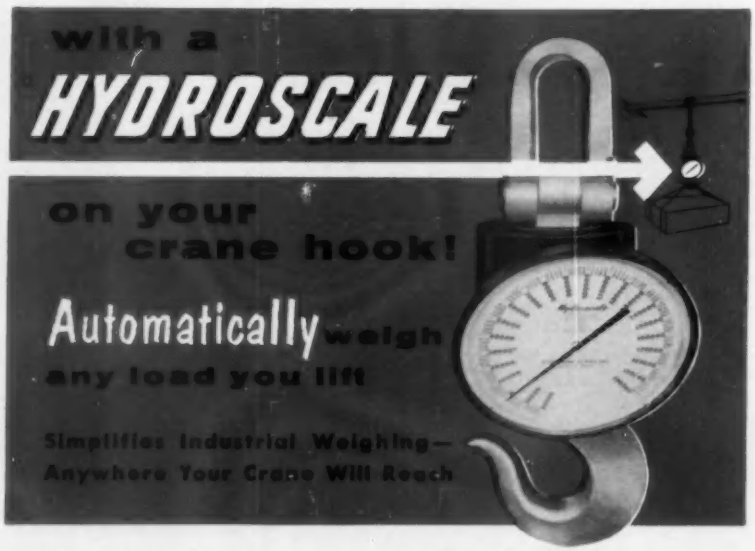
(*Continued from page* 36)

tures, and a turbocharged Diesel engine.

One of 16 basic air suspension models in the GMC truck line for 1957, Model DRA 802 is rated at 55,000 lb GCW and weighs only 9434 lb. Gross vehicle weights (GVW) of this and other air suspension models in the GMC line range from 25,000 to 42,000 lb and gross combination weights (GCW) from 50,000 to 65,000 lb.

The new trucks will be available with gasoline or Diesel engines. Four of the basic models have four-cylinder 4-71T turbocharged Diesel engines developing 171 hp.

A 190-hp, six-cylinder 6-71SE Diesel is standard on four other basic air suspension models.



ALL WEIGHING IS DONE ON YOUR CRANE HOOK
Merely hang your HYDROSCALE on the crane hook, or hoist, and leave it there. Then, whenever you lift a load, you'll automatically weigh it—in the one operation.

TARE ADJUSTING KNOBS FOR NET LOAD READING
All models are equipped with minus tare adjustment for any known tare loads. This exclusive feature, with HYDROSCALE, is provided to save an extra lift operation.

ENGINEERED AND BUILT FOR LONG SERVICE-LIFE
They are compact in design to clear narrow passageways and to conserve headroom. They are light in weight to conserve your crane capacity—with a safety factor of 5 plus.

HERE ARE SOME TYPICAL WEIGHING APPLICATIONS
Just a few of the many applications include—loading, unloading, check weighing, batching, foundry charging, and protecting your equipment from overloading.

THERE ARE 110 MODELS IN THE COMPLETE LINE
The largest model, not much larger than a man, has an amazing capacity of 200,000 pounds. The capacity of the smallest model is 500 pounds.

EASY-TO-READ DIALS AVAILABLE IN 3 SIZES
They're available in 12", 24", and 30" diameters, printed plainly, in gothic characters, black on white, and, protected by safety glass.

HYDROSCALES guaranteed | They are guaranteed to be free of defects in workmanship and materials, and to be accurate to ½ of 1% of the maximum dial capacity—

HYDROWAY SCALES, INC.
20614-B West 8 Mile Road • Detroit 19, Mich.
"The world's largest producer of crane scales"

Cadillac Eldorado Brougham

First production model of Cadillac's "answer" to the plush Ford Continental Mark II makes its bow in the buyers' market on a limited output basis at the Show. Formerly an experimental car first seen at the 1955 GM Motorama (see AI, Jan. 15, 1955, p. 58), the Eldorado Brougham has been designed chiefly as a prestige car with air suspension.

Powered by a 280-hp V-8 engine, the four-door sedan is built of steel. Featured is a roof panel of satin-finished stainless steel.

Packard-Clipper Sedan

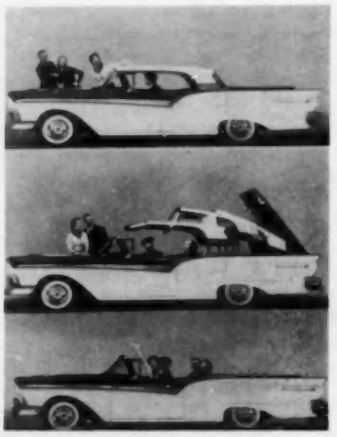
Scheduled to be introduced in mid-January by dealers, the Packard-Clipper for 1957 will be previewed at the Show. Production of the various models in the line is set to begin this month at South Bend, Ind.

No details on the car were available at press time. The company only stated that it will be considerably lower than previous Packard-Clipper models and will have a number of advanced engineering features.

Ford Retractable Hardtop

Production is due to start in January on Ford Division's new retractable hardtop (see AI, Oct. 1, p. 56). The six-passenger, two-door sedan will be displayed publicly for the first time at the show.

An instrument panel button is touched to raise or lower the steel top. Electric locks are released in the trunk lid, which rises up and back, out of the way. Then locks are automatically released in the top, which swings up, back, and down into the trunk. The trunk lid closes and locks itself.



Ford retractable hardtop sedan.

DU PONT
Better Things for Better Living
. . . through Chemistry

AUTOMOTIVE ENGINEERING NEWS

PROPERTY AND APPLICATION DATA
ON THESE VERSATILE ENGINEERING MATERIALS:
"TEFLON," "LUCITE"

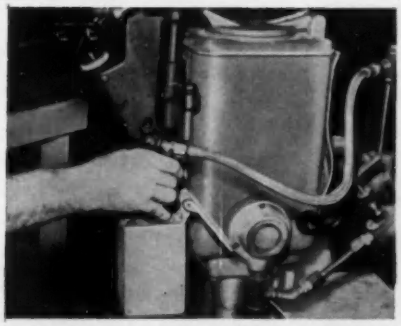
No. 5, 1956

VARI-Flare manufactured by VARI-Products Company, Chicago, Illinois. Reflectors molded by Stimsonite Division of the Elastic Stop Nut Corporation of America, Union, New Jersey.

Reflectors of Du Pont LUCITE® provide safer highway travel

LUCITE acrylic resin helps eliminate "sitting ducks"—cars or trucks stalled on the highway which don't warn oncoming vehicles of their predicament. The portable VARI-Flare pictured above provides the necessary warning in such cases. Its reflectors, injection-molded of Du Pont LUCITE, can be seen for a half mile or more.

LUCITE offers excellent opportunities for the automotive designer. It is available in a wide range of transparent, translucent, and opaque colors and can be molded into almost any size or shape. For more information on how this versatile material can help you with your design problems, clip and mail this coupon.



Hose lined with TEFLON is virtually unaffected by corrosive materials, despite constant flexing, over a broad temperature range. (Manufactured by Resistoflex Corp., Roseland, N. J.)

NEED MORE INFORMATION?

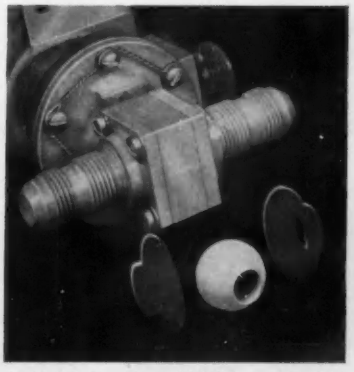
For further details that will help you further evaluate these materials for use in your product development program, mail the coupon at the right.

Unusual properties of Du Pont TEFLON® offer many mechanical design advantages

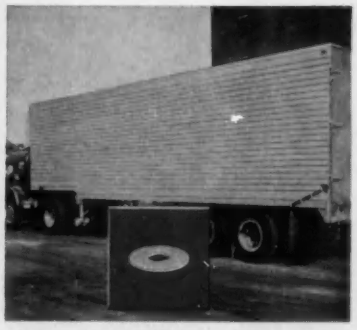
The unusual mechanical and chemical properties of TEFLON tetrafluoroethylene resin make it particularly adaptable to automotive applications. Used as thrust washers in trailer-hinge assemblies, TEFLON has withstood the wear of heavy, swinging doors and weathering for over five years, without replacement. Hose lined with TEFLON retains its flexibility and is unaffected by high-temperature fuels and other corrosive materials. Ball valve seals made of TEFLON demonstrate its ability to retain original size in contact with hydraulic fluids, water, air and other elements which would cause conventional materials to swell. Clamps using a liner impregnated with TEFLON are completely unaffected by all hydraulic fluids, lubricating oils and fuels. Because of the low coefficient of friction of TEFLON, these clamps can allow for rotational or longitudinal movement. These examples are typical of the success that can be achieved when using TEFLON in mechanical applications.

Basic property and application data on TEFLON tetrafluoroethylene resin is available to you. It will help you to evaluate this material for your own use. Simply clip and mail this coupon.

"Joclamps," initially developed for the aircraft industry, use liners impregnated with TEFLON for excellent chemical stability and age resistance, over a wide temperature range. Will not char or carbonize. In this and other applications, the self-lubricating characteristics of TEFLON assume importance. (Manufactured by the Joclin Manufacturing Company, North Haven, Connecticut.)



Molded ball seals of TEFLON provide tight, long-lasting seals for valves handling hydraulic fluids, water or air. (Manufactured by the Sparta Manufacturing Company, Dover, Ohio.)



Thrust washers used in trailer-door hinges are made of TEFLON. They stand up to rugged usage and require no lubrication. (Made by Brown Trailers Inc., Spokane, Washington.)

E. I. du Pont de Nemours & Co. (Inc.)
Polychemicals Department, Room 1712, Du Pont Building, Wilmington 98, Delaware

Please send me more information on Du Pont "Teflon" tetrafluoroethylene resin and "Lucite" acrylic resin. I am interested in evaluating this material for_____

NAME_____ TITLE_____

COMPANY_____

STREET ADDRESS_____

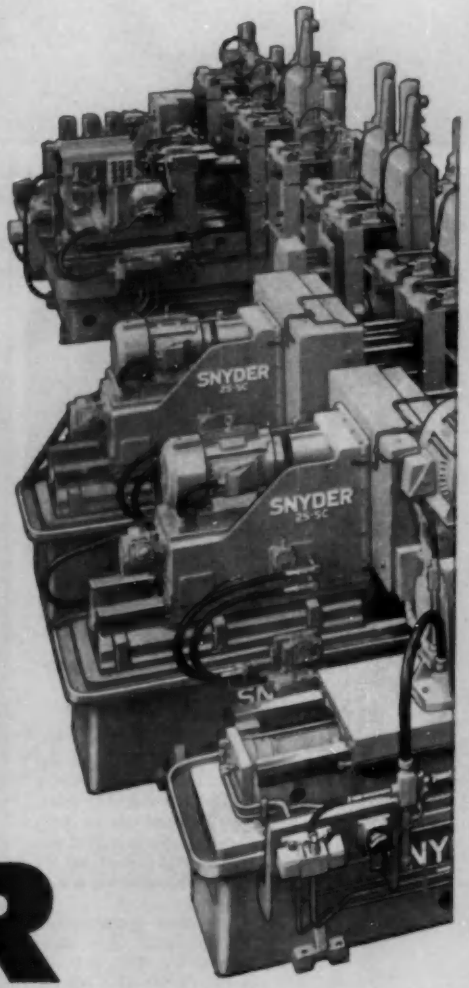
CITY_____ STATE_____

TYPE OF BUSINESS_____

UNIQUE FEATURES IN SNYDER 9-SEGMENT, 24-STATION, IN-LINE AUTOMATED TRANSFER MACHINE

for processing converter housings; independent control panels permit individual segment operation (co-ordinated with master panel); electric circuits can be individually checked by Circuit-Sleuth Panel; at Station 4, workpiece is re-oriented 90°; at Station 21, two dowel holes and one transmission hole are precision bored to .001 in size; at Station 22 these holes are automatically precision air gaged.

Workpiece reaches machine finish ground on both faces; machine performs 59 operations, delivers workpiece completed and automatically inspected. Production, 128 pieces an hour at 100% efficiency.

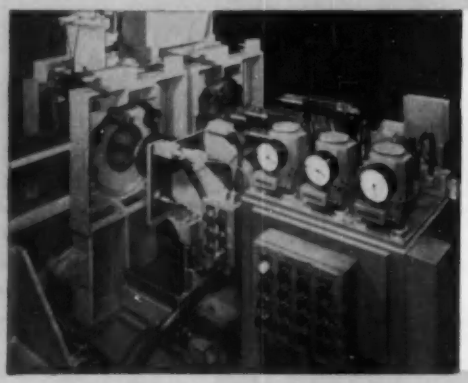


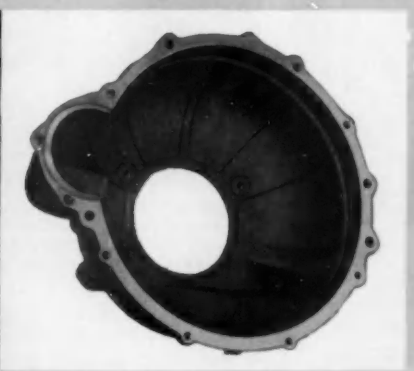
SNYDER

TOOL & ENGINEERING COMPANY

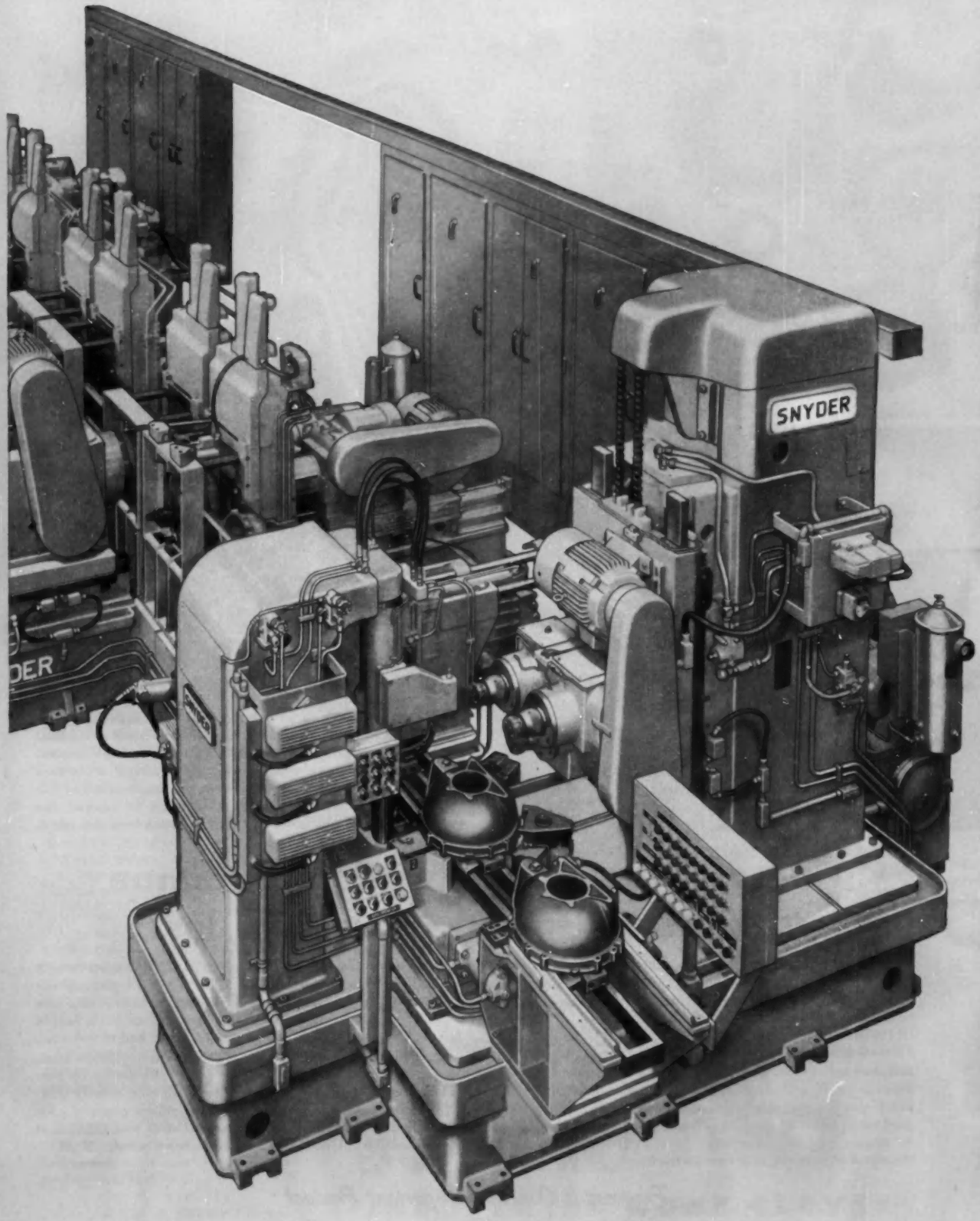
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

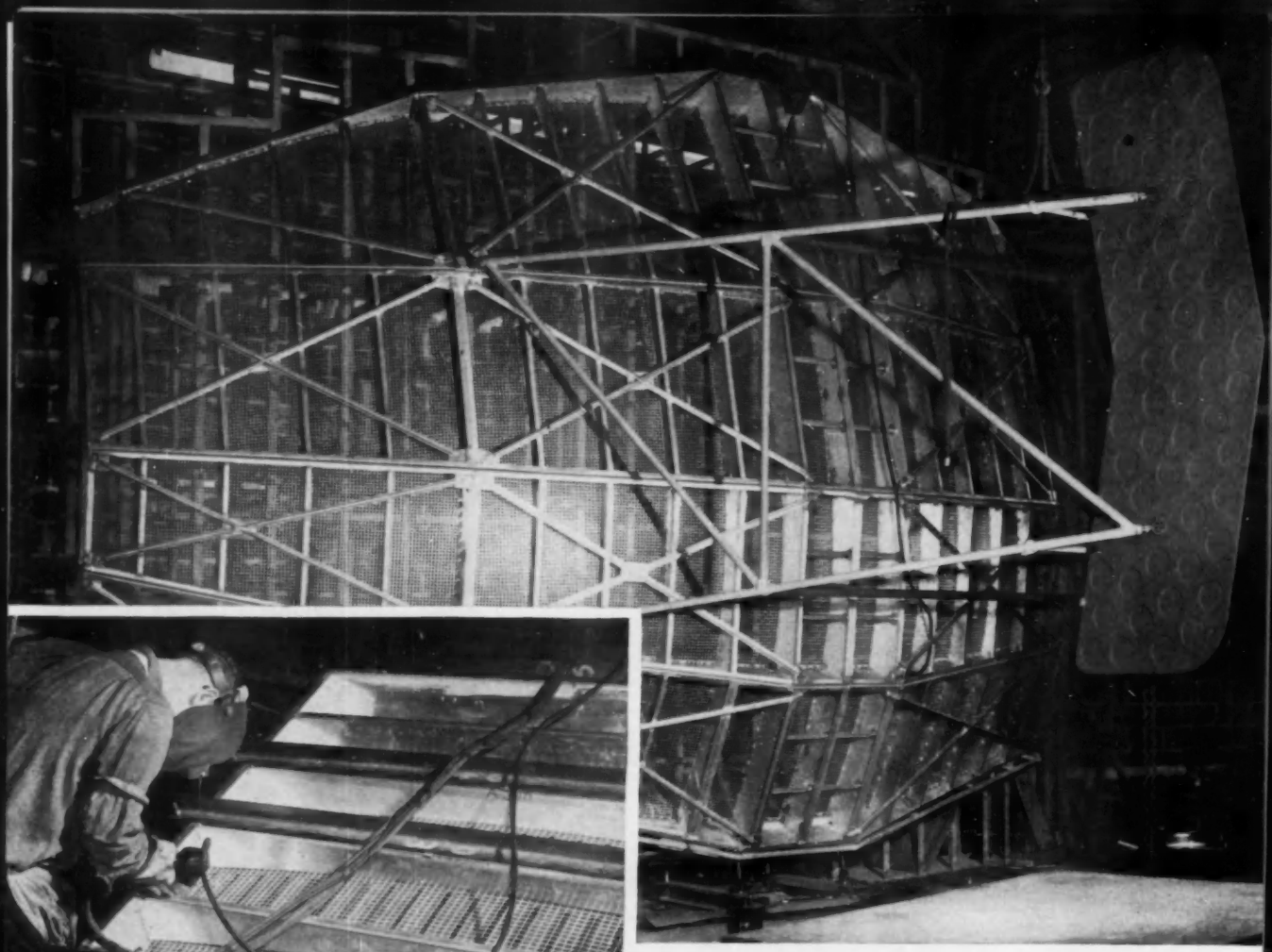
31 Years of Special Machine Tools with Automation





Boring and air gaging stations.


SNYDER



Completed aluminum radar antenna (above) stands more than 20 feet high at the Garden City, Long Island, plant of General Bronze Corporation. At left, a welding operator uses General Electric Fillerarc* equipment to weld $\frac{3}{32}$" diameter aluminum screen to an antenna section frame—a tough welding job because all welds must be sound enough to support the weight of the antenna under constant buffeting from the wind.

Fillerarc* welding of radar antennae is 10 times faster, costs 25% less

Fabricating giant, aluminum radar antennae can be a costly and time-consuming operation. But General Bronze Corporation of Garden City, N. Y., has found that compared with the tungsten-arc method formerly used, it can speed such welding 10 times while cutting costs 25 per cent with General Electric Fillerarc gas-shielded, consumable-electrode equipment.

Requirements for welding the antennae are demanding. Each antenna is composed of sections of varied size and shape, which must be assembled to form the completed unit. Materials used range from $\frac{1}{8}$" aluminum frame to $\frac{1}{16}$" cross channels and $\frac{3}{32}$" diameter aluminum screen.

*Registered trademark of the General Electric Co.

Preliminary tests using semi-automatic Fillerarc equipment resulted in strong, smooth welds, and the trouble and expense of cleaning up flux was eliminated. So, General Bronze now uses Fillerarc welding equipment on all its antenna work and is looking for other jobs Fillerarc can do faster and at less cost.

And, Fillerarc is versatile. It can weld mild and stainless steel, bronze, nickel, and magnesium. For more information on how Fillerarc can save you time and money, call your nearby General Electric welding distributor (see the yellow pages of your phone book), or write for bulletins GEC-989 and GEC-1334 to Section 713-6, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

AI TABLOID

(*Continued from page* 137)

Associated British Engineering, Ltd., has established a subsidiary in Canada to set up sales and services centers across the country for its free piston and other types of engines which it manufactures.

* * *

American University, Washington, D. C., will conduct its Ninth Institute on Industrial Transportation and Traffic Management from Jan. 8 through Jan. 25, 1957.

* * *

Townsend Co. has purchased a controlling interest in Impact Products, Inc., of Orangeville, O. . . . New Plastic Corp. has purchased Lansco Die Casting Co.

* * *

Canadian automobile factories in the first eight months of 1956 produced a total of 343,853 cars and trucks, of which 318,622 were for domestic use and 25,231 for export.

* * *

Du Pont Co. reportedly plans to boost production of cellophane by 10 million lb annually, with another 20 million lb to be added later. It also will step up by 50 per cent its presently undisclosed capacity to produce Mylar polyester film.

* * *

American Pulley Co. has purchased the Materials Handling Div. of Market Forge Co. and has taken over the manufacture and sale of its products.

* * *

Hooker Electrochemical Co. has synthesized a rubber which is said to withstand the heat of supersonic jets, atmospheric cold, and the attacks of fuels, lubricants, and hydraulic fluids.

* * *

Goodyear Tire & Rubber Co. has opened a $300,000 experimental garage for tire testing at Akron, O.

* * *

Du Pont Co. has announced development of a new Teflon 100-x perfluorocarbon resin.

* * *

General Tire & Rubber Co. has added a 14-in. snow-mud tire to its winter line.

CHOICE

Take yours—from the complete line of

JOMAC WORK GLOVES

Whatever your handling operations may be, you can choose with confidence the Jomac Gloves that are right for them. And you can be sure of getting quality—lasting quality, stemming from 18 years of pioneering and leadership in the industrial work glove field.

Jomac Work Gloves are:

- made of cut-resistant, loop-pile Jomac Cloth—the fabric that protects hands from cuts and abrasion like no other
- manufactured in knit wrist, safety cuff or gauntlet styles—in heat-resistant, flameproof, plastic-coated types
- great for economy—can be used, cleaned or reconditioned, and reused again and again
- adaptable—many styles are interchangeable, with *4* long-wearing surfaces per pair
- rugged—*they outwear canvas gloves by a profitable margin!*

Jomac manufactures all types of hand-to-shoulder protection. The choice is yours.

FREE JOMAC CATALOG

Write us (on your company letterhead) for your free Jomac Industrial Work Gloves Catalog—and for recommendations on types of gloves to use for your handling operations. We'll gladly supply sample gloves. Address: Jomac Inc., Dept. H, Phila. 38, Pa.

JOMAC

INDUSTRIAL WORK GLOVES

PLANTS IN PHILADELPHIA, PA., AND WARSAW, IND.
IN CANADA: SAFETY SUPPLY CO., TORONTO

OOPS!

SIGHTS of rockets swooshing heavenward become more and more familiar as we thumb through today's industrial publications. The recalcitrant rocket shown on this page indicates that things *can* go wrong in research, and we don't claim that the absence of a Sanborn oscillographic recording system somewhere along the line was the reason for this disappointing trajectory.

What we do wish to say is that Sanborn equipment is playing an increasingly vital part in rocket development. Used in the laboratory to record flight behavior simulated by analog computers, and in plotting rooms at testing bases to tape down telemetered data, Sanborn "150's" are helping rockets to get and stay where they belong.

You can see Sanborn systems in many other places, too. Oil fields, electronic component production lines, machine tool plants, hydraulic testing laboratories, numerous aircraft manufacturers, computing facilities . . . are putting single to 8-channel Sanborn systems to work. (Most are housed in vertical mobile cabinets, while those in the "field" are often divided into portable packages for each instrument.) All of them give their users inkless, permanent recordings in true rectangular coordinates, one percent linearity, as many as nine chart speeds, and the efficiency (and economy) inherent in Sanborn unitized design. A dozen different plug-in preamps further extend their value, by making changeover to new recording inputs a quick and easy procedure.

SANBORN COMPANY
CAMBRIDGE 39, MASSACHUSETTS

8-, 6-CHANNEL 4-CHANNEL 2-CHANNEL 1-CHANNEL 2-, 4-, 6-, 8-CHANNEL ANALOG COMPUTER SYSTEMS

Which way rockets are going may not be a primary concern of yours. But if recording problems are, you're apt to find some interesting and useful answers in Sanborn's 16 page "150 System" catalog. Write to us for a copy.

MEN *in the* NEWS

(*Continued from page* 38)

Joseph T. Ryerson & Son, Inc. — George E. Handtmann was appointed assistant to the president in charge of office operations.

Chrysler Corp., Engineering Div.—**Thomas C. Gleason** was named chief engineer for electrical development and design.

Waterbury Farrel Foundry and Machine Co.—**A. Dale Mitchell** has been elected president, and **Fred S. Van Valkenburg** has been named chairman of the board.

Black & Decker Manufacturing Co. —**Robert Appleby** has been appointed managing director of the Harmondsworth, England, subsidiary.

Thompson Products, Inc., Light Metals Div.—**Carl W. Haydl** is now administrative manager of the Aircraft Machining Dept.; **John Stobbs**, administrative manager of the Foundry Dept.; **Dean Garrett**, administrative manager of the Piston Machining Dept; and **William Reinberger**, acting administrative manager of the Extruded Products Dept.

Ford Motor Co.—**William L. Wallace** has been named styling administration manager, and **Lowell F. Sarnes** has become director of the quality control office, succeeding **Roscoe Smith**, retired.

Pratt & Whitney Co. — **Irvin F. Holland**, general superintendent of the Cutting Tool and Gage Div., has retired.

Erie Forge Steel Corp.—**Charles A. Shenberger** was made general sales manager.

Frank G. Hough Co. — **Frank G. Hough** was elected chairman of the board, and **G. A. Gilbertson** succeeds him as president and chief operating officer.

Leece-Neville Co.—**Joseph J. Ribar** has been named factory comptroller for all plants.

Yale Materials Handling Div., Yale & Towne Manufacturing Co.—**Richard C. Slater** has been named manager of Worksaver and Warehouser sales, and **Richard H. Marsh** has been made southern regional sales manager.

(*Turn to page* 152, *please*)

For GEARS to build AMERICA'S ROADS

GEARS, thousands of them, will go into the construction machinery needed for our nationwide program of building highways and roads. An increasing number of these will be Fairfield Gears. Already one of America's largest independent producers, Fairfield's facilities are being further enlarged this year with approximately one hundred percent more space in heat treating and thirty-three percent more space for machine installations.

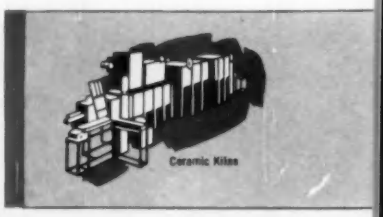
If you use gears in the product you make, we believe it will pay you, as it has others, to become acquainted with FAIRFIELD —the place where fine gears and differentials are produced to meet your specifications EFFICIENTLY, ECONOMICALLY! *Your inquiry will receive prompt attention.*

FAIRFIELD
MANUFACTURING CO.
2303 S. Concord Rd. Lafayette, Indiana

Fine Gears For FINE GEARS *Made to Order*

TRACTORS • CONSTRUCTION MACHINERY • ENGINES • BUSES • FARM IMPLEMENTS • MINING MACHINERY
DIESEL LOCOMOTIVES • MACHINE TOOLS • AIRPLANES • HEAVY DUTY TRUCKS • OIL FIELD EQUIPMENT

BRAND-NEW IDEA in heat treating furnaces



o o proving again . . . .

FOR CARBONITRIDING, BRIGHT HARDENING, CARBURIZING OF SMALL METAL PARTS

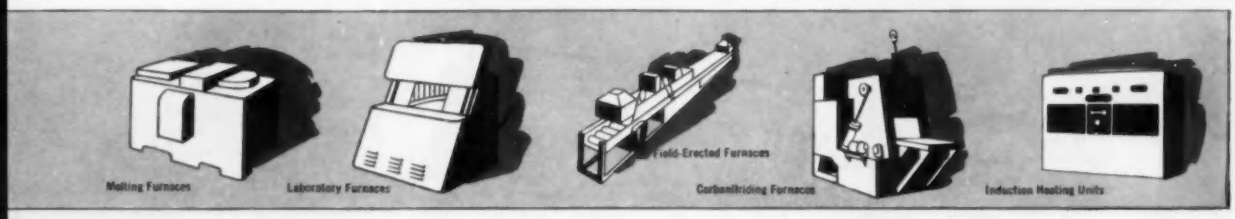
This is a completely new furnace, an exclusive Lindberg development. It is the first time induction heating has ever been offered in a heat treating furnace. No elements, no burners, no electrical or gas connections in it. Heating efficiency is high and the furnace can be brought to hardening temperatures in 17 minutes from cold. Temperature control is highly accurate, eliminating temperature override and lag for all practical purposes.

The Induct-O-Ring's circular shape eliminates door-opening heat and atmosphere losses and saves floor space. Work load is automatically charged and moved through the work chamber by a gentle, quiet, reciprocating movement of the furnace. The furnace is completely adaptable to automatic production processes, where its precise heat control, negligible maintenance and dependable operation are of particular importance.

- **No elements, no burners**
- **No gas or electric connections in furnace**
- **Built like a fine machine tool**
- **Precise temperature control**
- **Very low maintenance**
- **Quiet, automatic, trouble-free**

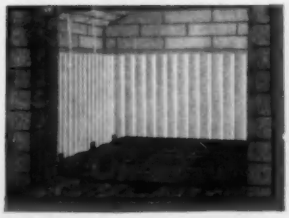
induct-O-ring*

*U.S. and foreign patents pending



. . . it's better to talk it over with LINDBERG

If you are concerned with the application of heat to industry it makes good sense to talk it over with the most widely experienced experts you can find. We believe we have them here at Lindberg. Our only job is developing industrial heating equipment and we offer the most complete line in the field; heat treating furnaces, melting furnaces, high-frequency induction units, ceramic kilns; big ones, small ones, built in our own plant or field-erected. This gives us the experience and know-how to come up with something really new, like this revolutionary Induct-O-Ring furnace, time and time again. So take your industrial heating problems to the experts. Our engineers and technicians can have the right answer. Talk it over with Lindberg.



Another Lindberg achievement! The use of electricity in carbonitriding and carburizing furnaces has been made completely practical by Lindberg's recent development of the CORRTHERM electric heating element. This element is now being used in many furnace installations where ordinary electric heating elements could not operate successfully.

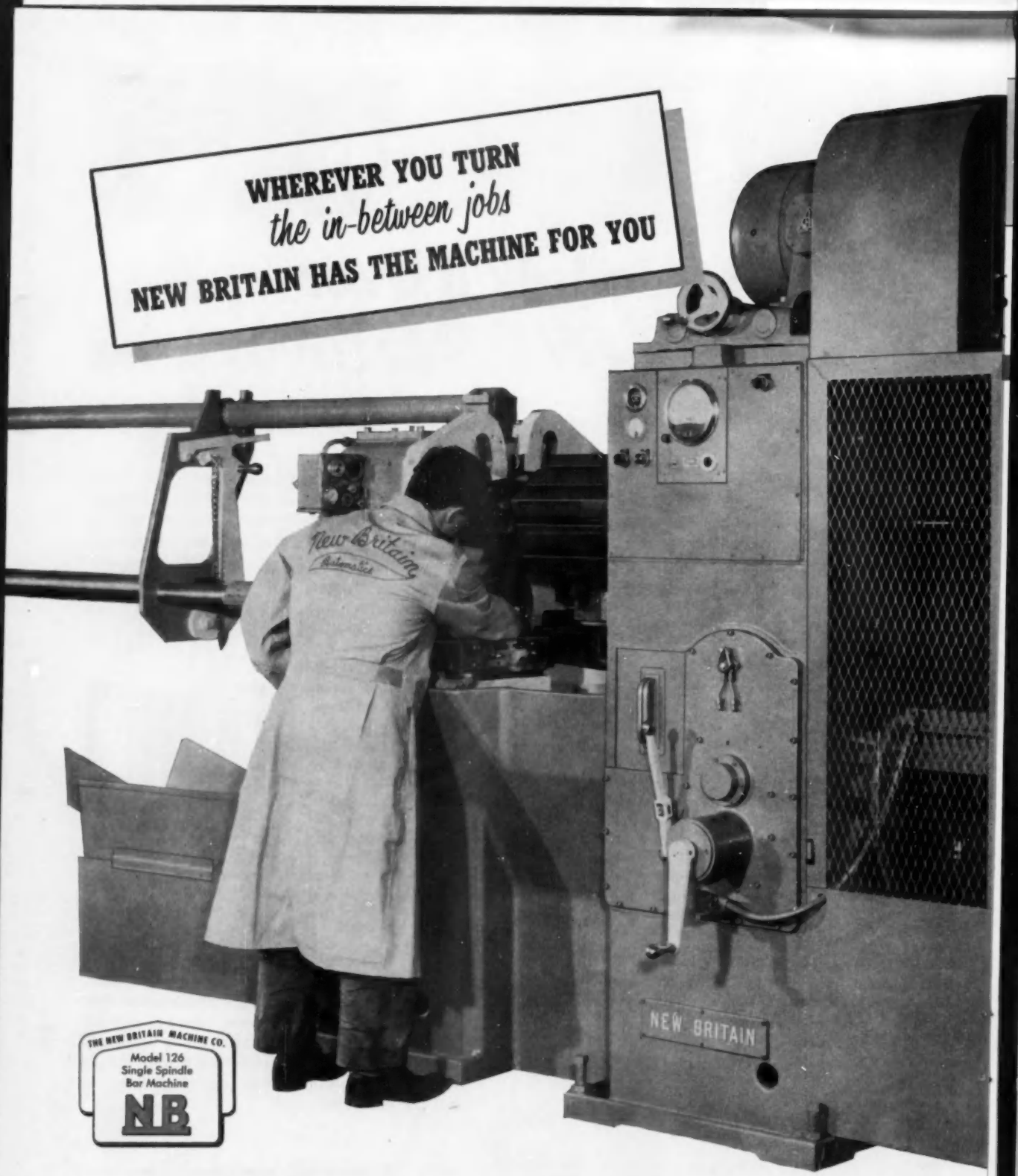
For fuel-fired furnaces, another important development, the famous "dimple" vertical radiant tube was created by Lindberg. This lightweight, easily-changed tube provides a big advance in furnace efficiency and effects a marked saving in operation and maintenance costs. Minimizes shut-downs and costs for tube changes.

Through the years Lindberg research and development laboratories have originated and perfected many other important heating processes, developments such as the Cyclone tempering furnace, automatic control of carbon potential in furnace atmospheres, 60 cycle induction melting and completely automatic ceramic kilns.

Many important Lindberg developments have come as a direct result of some good customer's need. With the customer's cooperation Lindberg engineers have frequently provided an answer to some pressing production problem. You will benefit, too, whether you need some specific Lindberg equipment or have an industrial heating problem that needs a solution if you'll just talk it over with Lindberg. Call your nearest Lindberg Field Representative. There's one (see your phone book) in every major industrial center.

LINDBERG ENGINEERING COMPANY
2491 West Hubbard Street, Chicago 12, Illinois
Los Angeles Plant: 11937 S. Regentview Ave., at Downey, Calif.

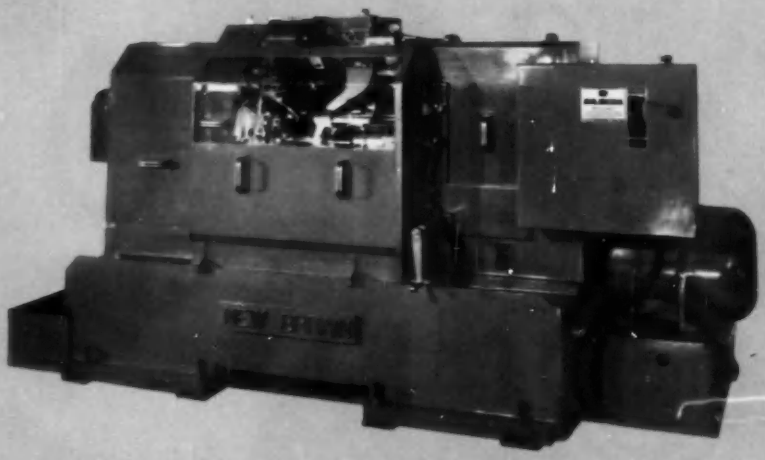
Associate Companies: Lindberg Industrial Corporation, Chicago • EFCO-Lindberg, Ltd., Montreal, Canada • Lindberg Italiana, Milan, Italy • The Electric Furnace Company, Ltd., Weybridge, Surrey, England • Etablissements Jean Aubé, Paris, France • Lindberg Industrie Ofenbau, Gross Auheim, Germany • Toyo Menka, Tokyo • Lindberg Engineering Company (Australia) Pty. Ltd., Melbourne



In the big borderline area of production between hand screw machines and multiple spindle types, the Model 126 New Britain single spindle bar machine can make money for you. It's rugged, fast and highly accurate. It requires minimum set-up time for tool changes, cross slide cam settings and positioning of operational sequences on the central program drum. Capacity 2⅝". May we mail you more details?

WHEREVER YOU TURN
on multi-spindle bar machines
NEW BRITAIN HAS THE MACHINE FOR YOU

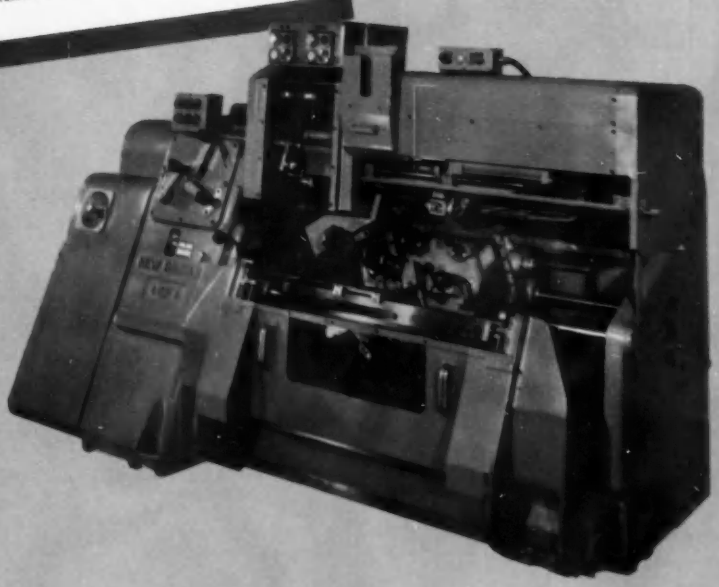
THE NEW BRITAIN MACHINE CO.
Model 62
Automatic Bar
Machine
NB



The new Model 62 New Britain bar machine has an independent radial cross slide in every position — opening new possibilities for effective tooling. New Britain "accuracy features" include spindle carrier lifting to eliminate wear during index, plus rigid locking of the carrier during the cutting cycle. Magazine loading available if desired.

WHEREVER YOU TURN
long or short runs
NEW BRITAIN HAS THE MACHINE FOR YOU

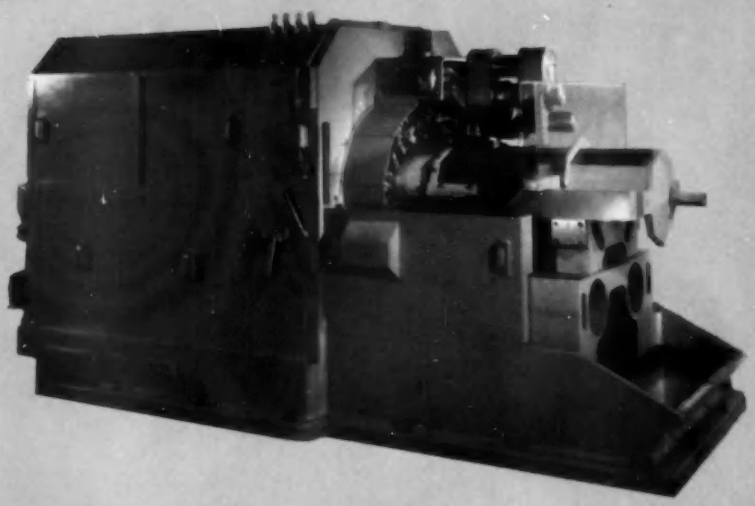
THE NEW BRITAIN MACHINE CO.
Model 11/70
New Britain +GF+
Copying Lathe
NB



The original New Britain **+GF+** copying lathe has grown into an extensive line, to meet the demand for the wide variety of applications for its better copy-turning principle. Regardless of length of run or the variety of pieces you make, you can use the New Britain **+GF+** profitably. Basic advantages are: fast setup, inexpensive tooling, elimination of the chip problem, minimum operator fatigue, and dimensional accuracy with good surface finish to reduce grinding allowances. Optional features include automatic re-cycling, automatic loading and ejecting.

WHEREVER YOU TURN
castings, forgings or pressed metal pieces
NEW BRITAIN HAS THE MACHINE FOR YOU

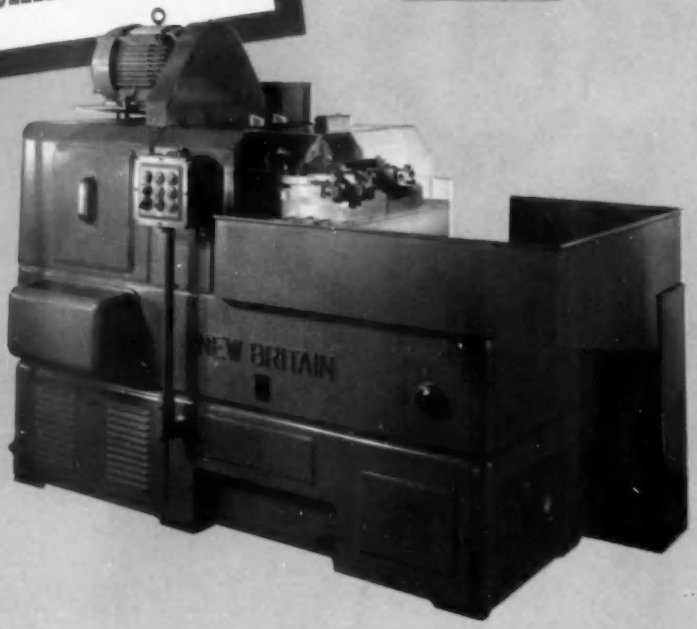
THE NEW BRITAIN MACHINE CO.
Model 810
Automatic
Chucking Machine
NB



Versatility, accessibility, quick setup and sustained high production of precision parts are what you look for in an automatic chucker. New Britains are famous for these features all over the world. Perhaps you are also thinking of the possible savings which automatic loading, unloading and automatic gauging could effect. If so, you will want to learn about the imaginative use of automated production which New Britain engineers are applying to chucker work these days. You can now handle bigger pieces than ever on New Britains too — up to fifteen inches in diameter.

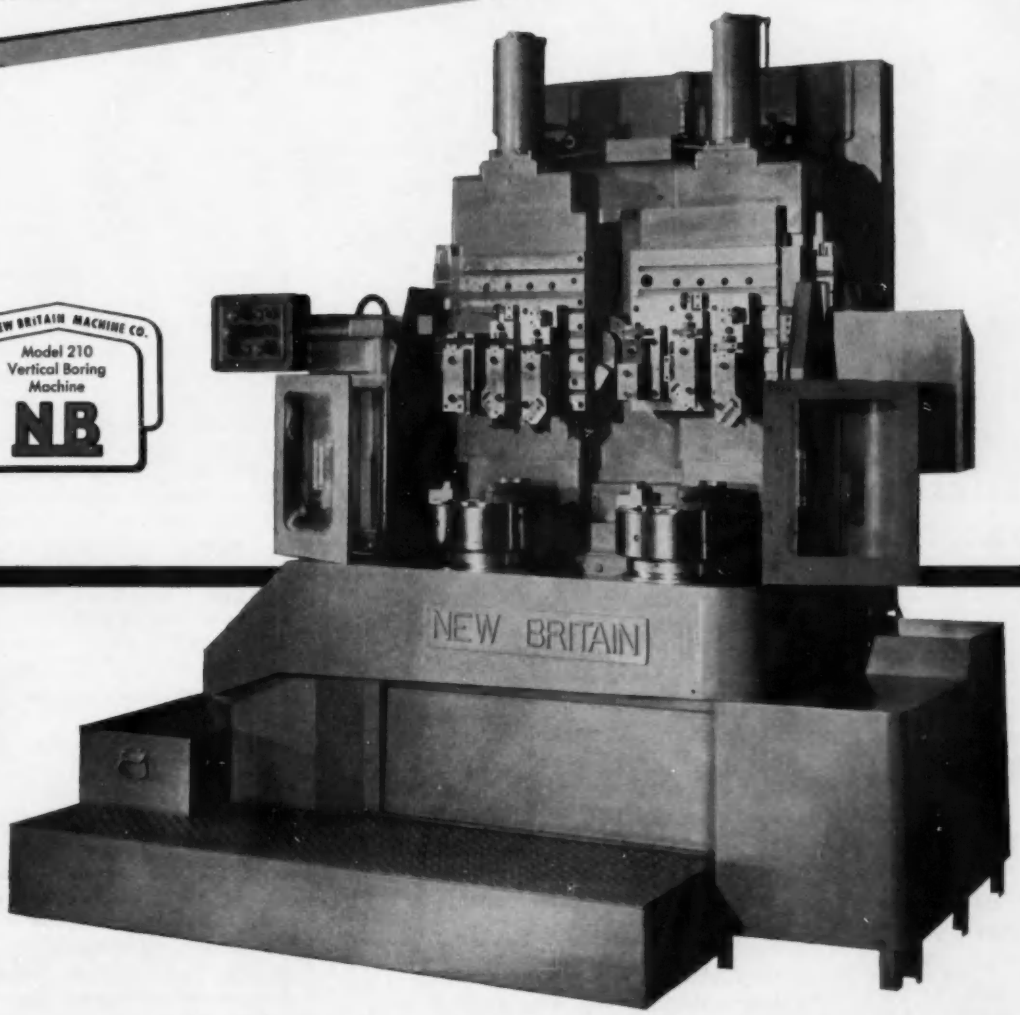
WHEREVER YOU TURN
or bore precision contour work
NEW BRITAIN HAS THE MACHINE FOR YOU

THE NEW BRITAIN MACHINE CO.
Model 37
Precision Boring
Machine
NB



New Britain precision straight and contour boring machines provide a new approach to machining parts that would be problem pieces on any other type of equipment. These simple, fast, accurate machines require minimum attention and utilize inexpensive single point tools. They make the most profitable use of automatic loading, gauging and tool adjustment where these features fit the job requirements. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

WHEREVER YOU TURN
or bore large, heavy pieces
NEW BRITAIN HAS THE MACHINE FOR YOU



Accurate cam control of tool paths is the essential to precision contour boring. The Model 210 New Britain precision *vertical* boring machine extends the speed, accuracy and fine finish of precision straight and contour boring and turning to a wider variety of work pieces. Perhaps this is the answer to excessive costs on some of *your* work.

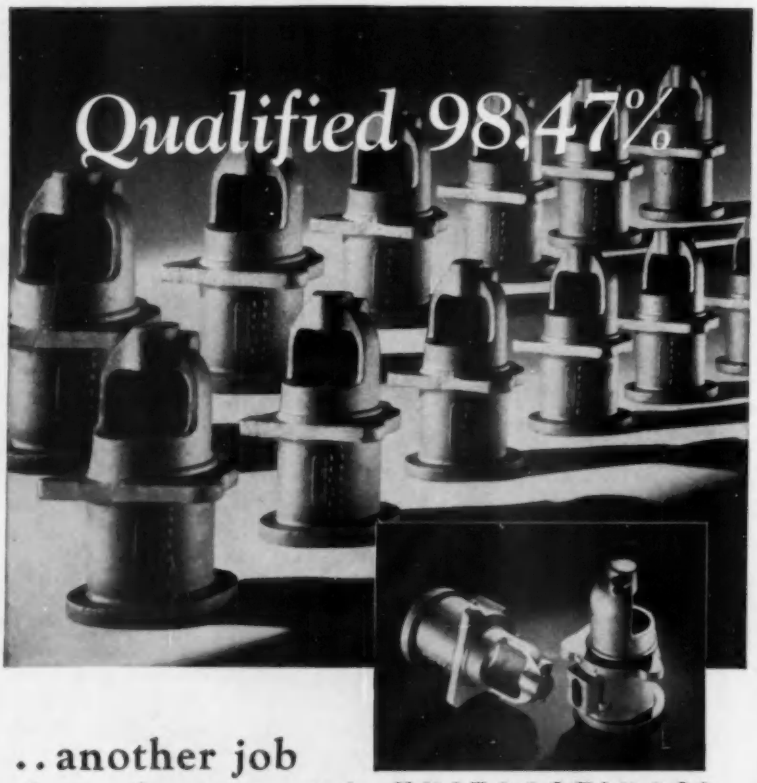
NEW BRITAIN-GRIDLEY MACHINE DIVISION

The New Britain Machine Company • New Britain, Connecticut

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS

LUCAS MACHINE DIVISION
Cleveland, Ohio
Precision Horizontal Boring, Drilling and Milling Machines

HOERN & DILTS DIVISION
Saginaw, Michigan
Multiple Spindle Precision Finishing Machines



..another job
done better with *UNITCASTINGS!*

Faced with a problem of economically producing a starter housing that would take more than normal abuse, Unitcast engineers successfully provided the answer with *steel* castings. Previous to the use of Unitcastings, replacement costs were excessive and the need of a tougher material was imperative. Cost was also an important requisite, and by delivering *consistent* quality in conjunction with a tougher material—scrap and lost time has been held at a minimum. To date, more than 33,000 units have qualified with a higher basic cost being offset by practically no replacement and most important —a lower *finished* cost!

Take another look at the *finished* cost of your parts inventory —perhaps you *can do better with Unitcastings!* Consult a Unitcast engineer, soon!

UNITCAST CORPORATION, Toledo 9, Ohio

In Canada: CANADIAN-UNITCAST STEEL, LTD., Sherbrooke, Quebec

Unitcast

QUALITY STEEL CASTINGS

MEN *in the* NEWS

(*Continued from page* 145)

Aro Equipment Corp. — K. H. Zinsmaster was promoted to manager of procurement and production planning.

Sundstrand Michigan Corp.—**H. R. Leber** has been named a vice-president. He continues as general sales manager of the Machine Tool Div. of Sundstrand Machine Tool Co.

Joseph T. Ryerson & Son, Inc.—**Veron D. Rogers** is now general office manager; **James E. Dittus,** director of quality; **Rolla R. Ross,** manager of systems and procedures; **George G. Moody,** office manager for the general office; **George H. Blank,** assistant to the general office manager; and **Clive C. Earle,** manager of alloy and stainless steel sales at the Pittsburgh, Pa., plant.

Heald Machine Co. — **Albert A. Arbogast** is now Detroit branch manager, while **Gerald P. Robert** is assistant manager.

Boeing Airplane Co.—**Thomas A. Nelson** has been appointed director of sales.

A. Schrader's Son Div., Scovill Manufacturing Co.— **David A. Jones** has been named accessories sales manager.

Lamson & Sessions Co.—**Robert G. Patterson** was made assistant to the president, and **James G. Rayburn** was elected vice-president and general sales manager.

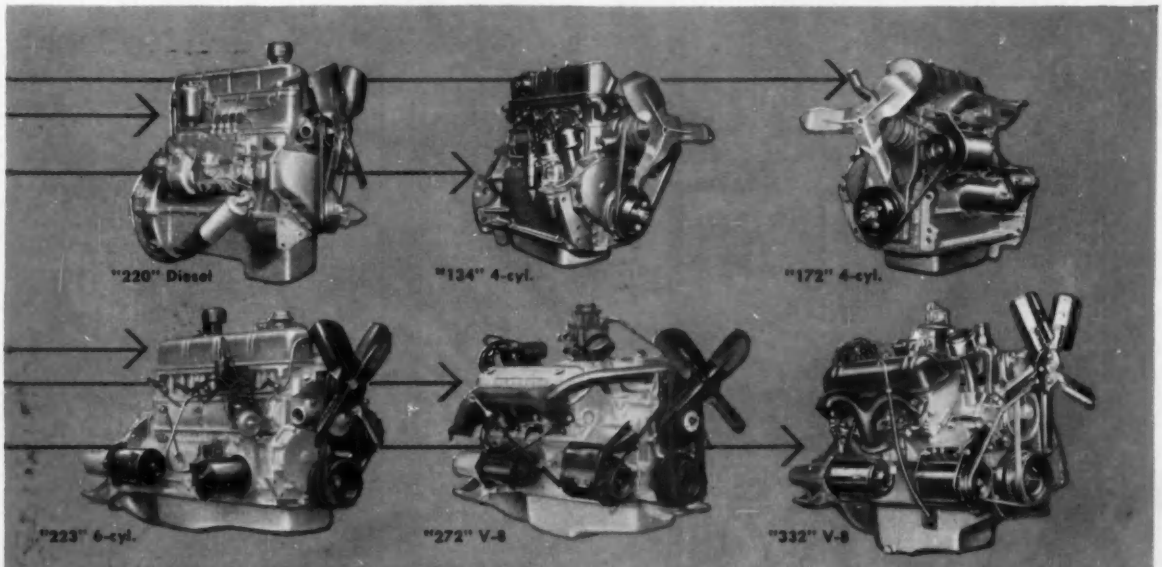
Electric Storage Battery Co., Automotive Div.—**Harry N. Roberts** has been appointed assistant general sales manager.

H. K. Porter Co., Inc.—**Sam Gurley, Jr.,** has been elected vice-president of sales.

Teer, Wickwire & Co. — **H. D. Federer** has been elected president and general manager.

Vertol Aircraft Corp.—**Edward J. Doherty** is now assistant to the president in charge of public relations and advertising.

Pratt & Whitney Aircraft Div., United Aircraft Corp. — **Earl E. Champion** has been named purchasing manager.



There's a Ford Industrial Engine to meet your power needs!

ENGINE SERIES		220 DIESEL	134 FOUR	172 FOUR	223 SIX	272 V-8	332 V-8
Basic Model		X	E	D	F	J	L
Type		4-Cyl. O.H. Valve	4-Cyl. O.H. Valve	4-Cyl. O.H. Valve	6-Cyl. O.H. Valve	V-8, 90° O.H. Valve	V-8, 90° O.H. Valve
Bore and Stroke—Inches		3.94 x 4.52	3.44 x 3.6	3.9 x 3.6	3.62 x 3.6	3.62 x 3.3	3.8 x 3.66
Displacement—Cubic Inches		220	134	172	223	272	332
Brake Horsepower	Dynamometer	60 @ 2250	48 @ 2800	61 @ 2800	107 @ 2800	132 @ 2800	168 @ 2800
	Continuous	48 @ 2250	38 @ 2800	48 @ 2800	86 @ 2800	106 @ 2800	134 @ 2800
Torque	Dynamometer	151#' @ 1600	110#' @ 1400	148#' @ 1300	202#' @ 1800	250#' @ 2400	320#' @ 2400
	Continuous	121#' @ 1600	88#' @ 1400	119#' @ 1300	162#' @ 1800	200#' @ 2400	256#' @ 2400
Compression Ratio		16 to 1	6.6 to 1	6.75 to 1	7.8 to 1	7.8 to 1	7.5 to 1

Specifications subject to change without notice.

And, Ford Industrial Power is *RIGHT* in all these ways:

❶ For your particular application, there's a choice of six rugged power plants . . . ranging from 134 to 332 cu. in. displacement. These are available either as engine assemblies or complete power units in either open or closed types (skid- or foot-mounted) with a number of special accessories to serve special needs.

❷ Ford Industrial Engines offer the most advanced and proven benefits derived from the continual research and matchless facilities of Ford's huge engineering staff. For this reason, you're always right up-to-date when you specify Ford Heavy Duty Power for your job—either as original equipment or for replacement.

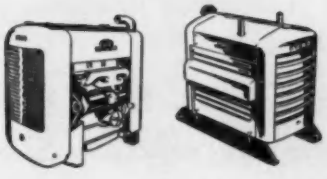
❸ The network of Industrial Engine Dealers covers the nation. That's a distinct advantage to you as a user of industrial power because it means there is a Ford Industrial Headquarters near you with the facilities needed to properly apply Ford Power. The net result is the right engine installation for your job.

❹ Users need never carry large stocks of replacement parts because Ford Industrial Engine service is everywhere. The more commonly purchased parts may be obtained quickly and economically from your nearest Ford Dealer or from many independent shops—wherever the Genuine Ford Parts sign is displayed.

SEE THE FORD INDUSTRIAL ENGINES AT THE:

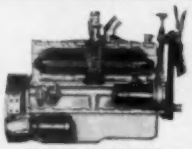
American Road Builders Association Road-Show
International Amphitheatre, Chicago, Ill., January 28-February 2—Booth 825

Ford
INDUSTRIAL ENGINES
AND POWER UNITS

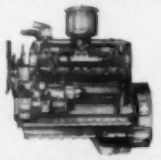


INDUSTRIAL ENGINE DEPARTMENT
FORD Division of FORD MOTOR COMPANY
P.O. Box 598, Dearborn, Michigan

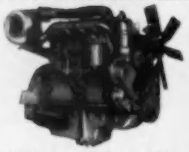
This is HERCULES MOTORS Today


L-HEAD GASOLINE

OVERHEAD-VALVE GASOLINE


TURBULENCE-CHAMBER DIESEL

DIRECT-INJECTION DIESEL


TURBOCHARGED DIESEL

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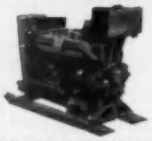
Yes, this is Hercules Motors, today—all types of dependable power for modern industry. The Hercules line includes more than 90 different models of engines and complete power units ranging from 3 to 500 H.P.

An ever-growing list of customers are solving their power problems with these types of Hercules Engines: L-head gasoline, overhead-valve gasoline, natural gas, L.P.G., turbulence-chamber diesels, direct-injection diesels, Turbo-Charged Diesels, marine diesels and complete open, closed and base type power units.

Write for more information on any of these dependable power plants. Our sales-engineers will be happy to help solve your power problems. No obligations, of course.


L.P.G. OR NATURAL GAS

POWER UNITS

MARINE DIESELS

HERCULES MOTORS CORP.

Engine Specialists Since 1915 • Canton, Ohio

Industry News

(*Continued from page* 37)

Chrysler Sales and Earnings Fall Sharply in Nine Months

Chrysler Corp.'s sales for the first nine months of 1956 amounted to $1,858,437,251, compared with $2,466,-251,614 sales for the first nine months last year. Consolidated net earnings for the first nine months of 1956 were $6,272,352, against earnings in the same period last year of $70,-637,012.

Passenger car and truck shipments in the first nine months of 1956 amounted to 763,718 units, or 33.3% less than the 1,145,255 units shipped during the same period in 1955. Third quarter shipments were 171,217 units, compared to 244,709 units in the same period last year.

Capital expenditures for improvements and additions to land, buildings, machinery and equipment aggregated $70,792,483 for the first nine months of 1956, compared with $102,986,640 in the same period last year. Defense work during the first nine months of 1956 amounted to $140,000,000 or about eight per cent of total sales, as compared to $130,-000,000, or about five per cent of total sales, for the 1955 period.

New GE Sealed Beams Developed For Cars With Four-Lamp Units

The Miniature Lamp Dept. of General Electric Co. has introduced two new sealed beam headlamps for 1957 cars using the quadruple lighting system. One lamp with two filaments —one for upper beams and the other for lower—is for installation in either the top or outboard section of the lamp housing, depending on whether the system is mounted horizontally or vertically.

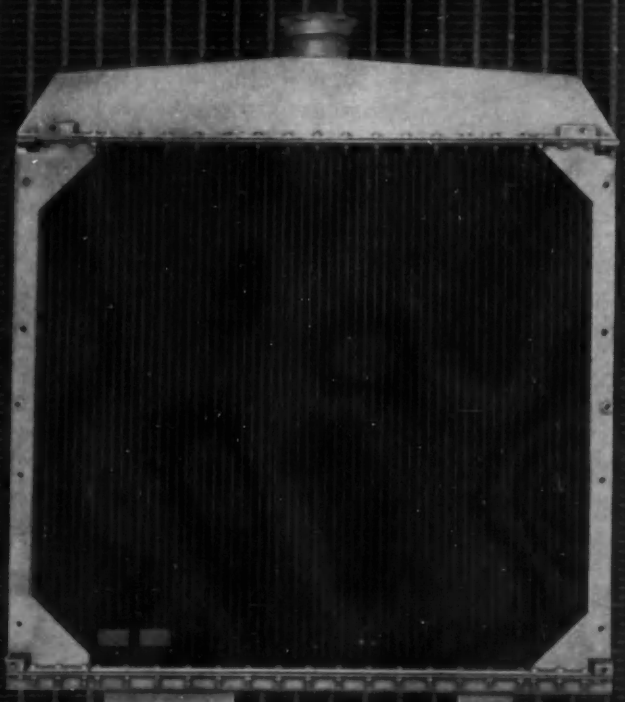
The other lamp, with only one filament for upper beam driving, is designed for the lower or inboard section of the system. When the lower beam is used, only the higher watt filament is lighted. Use of the upper beams automatically lights up all four headlamps.

Willys to Build Engines At Brazilian Operation

Willys Motors, Inc., will spend an additional $3.4 million to expand facilities at its Sao Paulo, Brazil plant. The new expenditudes will be used to construct an engine production plant.

(*Turn to page* 156, *please*)

The "blue bloods" of the construction industry depend on Perfex cooling



Allis-Chalmers
American Tractor
Austin-Western
Autocar
Baldwin-Lima-Hamilton
Bay City Shovels
Blaw-Knox
Bucyrus-Erie
Buffalo-Springfield Roller
Caterpillar
Clark Equipment
Continental Motors
Cummins Engine
John Deere
Detroit Diesel
Euclid
Four Wheel Drive
Galion
Gar Wood Industries
Harnischfeger
Heil
Hercules Motors
Hough
Hyster
Ingersoll-Rand
International Harvester
Jaeger Machine
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We are proud to be of service to a list of customers who are the "blue bloods" in the construction industry. If your name is not among those above, it may be to your advantage to let us show you how we can solve your engine cooling problems.

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Faster assembly . . . no more failures of fasteners. GREER STOP NUTS hold firm against jolts, shocks, shimmy, wobbles . . . any vibration, any kind.

Bolt threads are gripped tightly . . . these famous nuts *never* work loose. Yet an ordinary hand wrench gives instant release. The tough, built-in GREERCOID collar does it . . . and seals against fluid leakage, too!

Study *your* fastener problem. Over 3000 types and sizes. Consult GREER. Proved on thousands of products. Meets gov't and military specifications.

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GREER STOP NUT CO.
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GREER
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF
Stop Nuts

Industry News

(*Continued from page* 154)

Nankervis Starts Operations In New, Large Detroit Plant

Manufacturing operations got underway recently at the new George L. Nankervis Co. plant in Detroit. It will be used to design and build special testing equipment for the automotive and aircraft industries, as well as for activities of the company's subsidiary — Commercial Research Div.—which makes flowmeters and calibrating equipment.

Heald Precision Parts to Play Major Role in Highway Program

Typical of the many concerns that are looking forward to playing an important role in the new Highway Program highlighted in this issue of AUTOMOTIVE INDUSTRIES is The Heald Machine Co. Featured in the October, 1956, issue of the *Heald Herald* is a review of the numerous roadbuilding equipment parts that are produced on Heald Machines. The extensive survey of construction equipment and the multiplicity of precision parts used is an eye-opening one.

75% of Chrysler Employes Join Stock-Saving Plan

Chrysler Corp. reports that its new Thrift-Stock Ownership Program for salaried employes has been met with high enthusiasm. Some 75 per cent of the corporation's eligible employes already have joined the plan.

Curtiss-Wright Will Build New Turbomotor Div. Plant

Curtiss-Wright Corp. is building permanent facilities for its Turbomotor Div. on a 300-acre site in Lawrence Township, near Princeton, N. J.

Scheduled for occupancy in December 1957, the new installation will include a building for administrative and engineering offices; an experimental manufacturing building where prototype engines and components will be fabricated; and a development laboratory for testing full-scale engines and components at supersonic speeds at very high altitudes.

Complete production facilities, as well as test cells for research and sea level testing, will be added at a later date.

(*Turn to page* 158, *please*)

TETRASEAL
RECTANGULAR-SECTION RING BY GOSHEN RUBBER

this may be the **SEAL** *for* **YOU**

This high performance, economical static seal may save you money and grief over the type you are now using . . . in static, and in some cases moving applications. TETRASEAL rectangular-section rings by Goshen are non-laminated (in one homogeneous piece). Edges are accurately formed, and cross-sectional tolerances can be held to ± .004 depending on inside and outside diameter, on size of cross-section and on material desired. Now available in materials to meet MIL, AMS and commercial specifications. To find out what TETRASEAL can do for you, write for Technical Bulletin No. 11.

See our "Facilities" catalog in Sweet's Product Design File.

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QUALITY ENGINEERED RUBBER PRODUCTS

GET GOING WITH GOSHEN

a young production engineer finds a new way to cut costs

Production Scheduling

Why do we waste time and money on tapping?

Just drill and drive! No tap--no tap maintenance!

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Type I for metals
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ALL CAN BE HOPPER-FED!

SHAKEPROOF® Screws have a specially designed slot that cuts its own thread with true tapping action.

Each screw remains in the thread it has cut itself... assures a tight, vibration-resistant bit. Can be removed and re-used if desired

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Eliminate Tapping
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They never let you down on deliveries when you have to keep production going full speed.

You get *what* you order *when* you order it . . . from Garrett. No waiting for late shipments. You can't beat Garrett service. No worries about Garrett . . . quality. Every Garrett washer, hose clamp, stamping or assembly is right up to the peak of quality. High quality is assured by Garrett's "statistical quality control" system.

Next time no more headaches for me. I'll order from Garrett. Why don't you do the same when you need . . .

LOCK WASHERS
FLAT WASHERS
HOSE CLAMPS
STAMPINGS

Manufactured by
GEORGE K. GARRETT CO., Inc.
Philadelphia 34, Pa.

Garrett
OF PHILADELPHIA

Industry News

(*Continued from page* 156)

Finance Men See Tighter Terms But Enough Money for 1957 Cars

Top finance officials forecast a general tightening of credit terms, if the present tight money situation continues, but are confident that enough new money will be forthcoming to finance an expected 10 per cent increase in new car sales in 1957. They also expressed the belief that higher price tags will not have any significant effect on sales, if the public likes the new models. These opinions were voiced at a recent meeting in New York City of the American Finance Conference, an organization of 380 independent sales finance companies.

The sales finance men estimated that from $2 to 3 billion in new money needed to finance expanding car production next year will have to come from savings. "The demand for money far exceeds savings," said Edwin P. Latimer, president of American Discount Co. of Georgia, "and savings must be increased substantially before the tight money market eases."

Financing terms on new cars will tend to be shorter and more selective, and costs to automobile buyers will probably be higher, it was pointed out. The trend toward liberal credit terms "has slowed down to a walk," one official said, but he noted that some cars are still being sold on terms of 36 months.

The prime rate has gone up from 3 to 4 per cent since last April, an increase of 33⅓ per cent, according to R. Earl O'Keefe, president of Southwestern Investment Co. "We haven't been able to pass on this increase to the customer," he said, "but we have reached the point where we can't absorb anymore."

The money situation should be eased considerably by the present rate of liquidation of outstanding automobile installment debt, Dr. Thomas W. Rogers, executive vice-president of the American Finance Conference, pointed out.

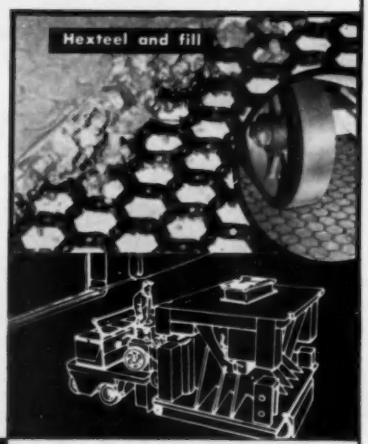
Dirt Found To Be Main Cause Of Engine Bearing Failure

The Automotive Engine Rebuilders Association has come up with some interesting findings about causes of engine bearing failure. A study covering a seven-year period lists dirt as the major offender with 42.98 per cent.

SPEED IS YOUR BUSINESS!
DON'T LET POOR FLOORS CAUSE A LOSS IN PRODUCTION!

Use **KLEMP HEXTEEL**
STEEL SURFACE ARMOR

. . . and prevent cracks, ruts, pot holes, spalling and other costly damages. Increases life and efficiency of all industrial surfaces subjected to lift trucks, platform trucks and other steel-wheeled vehicles. Install Klemp Hexteel in new concrete floors, or for resurfacing existing wood and concrete surfaces. Fill with concrete, mastic, hot or cold asphalt or magnasite.



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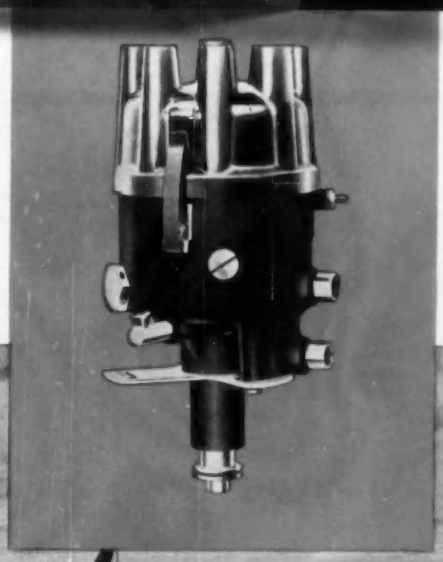
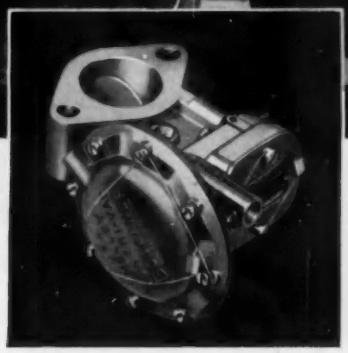
'57 Dodge Truck engine to use newly-designed Holley Distributor





First installation of the Rotovance Distributor (above) and Holley Governor (at right) will be on 1957 Dodge Truck models equipped with 354 engines. Two governors are used when the 354 engine is equipped with dual carburetion.

The first basic distributor design change in over two decades – Holley's new Rotovance Distributor and sandwich governor assembly – is standard equipment on the 354 cu. in. Dodge Truck engine for 1957. This distributor-governor combination is the first to locate control valve and advance mechanisms in a single housing.

The Rotovance Distributor and governor systems provide positive, consistent engine speed control – without power loss – with much better regulation than ordinary governors, from cut off to load point. Also standard on all Dodge Trucks equipped with Rotovance Distributors: Holley Ventilated Contact Sets. These unique center-vent points have proven in the laboratory and field alike to have a service life expectancy several times that of present contact sets.

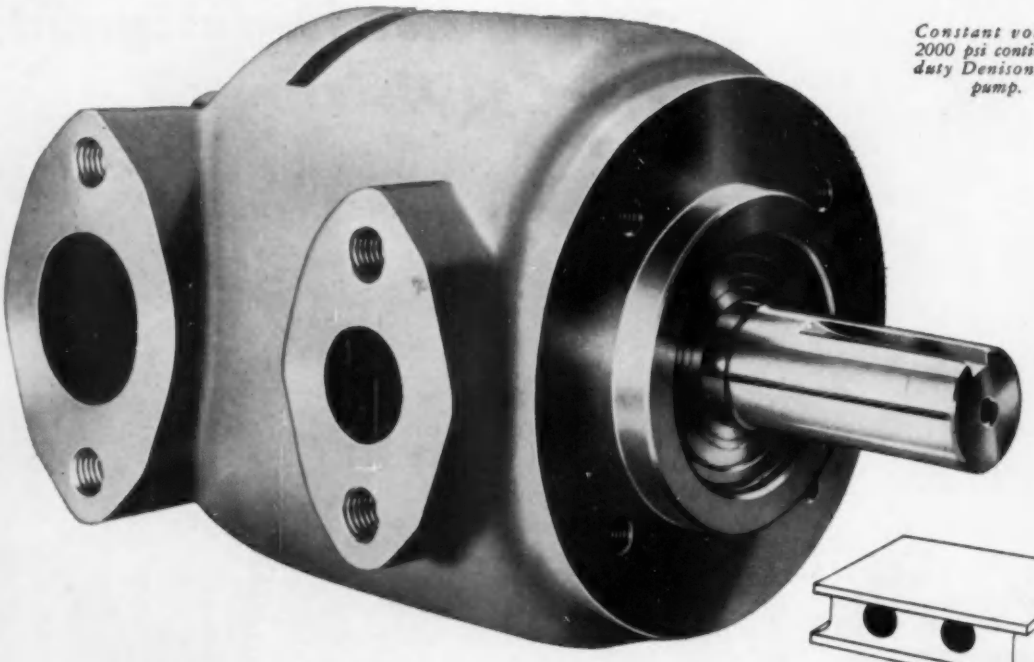
See the new Holley Rotovance Distributor with sandwich governor at your nearby Dodge Truck dealer. It's one of the many advanced-design features which help give new "K" Series Dodge Trucks greater power and increased engine performance for 1957.

HOLLEY
Carburetor Co.

11955 E. NINE MILE ROAD
VAN DYKE, MICHIGAN

FOR MORE THAN HALF-A-CENTURY—
ORIGINAL EQUIPMENT MANUFACTURERS
FOR THE AUTOMOTIVE INDUSTRY

T-6



Constant volume 2000 psi continuous duty Denison vane pump.

Hydraulically balanced vane utilizes internal oil pressure to maintain constant pressure of sealing edges against cam ring.

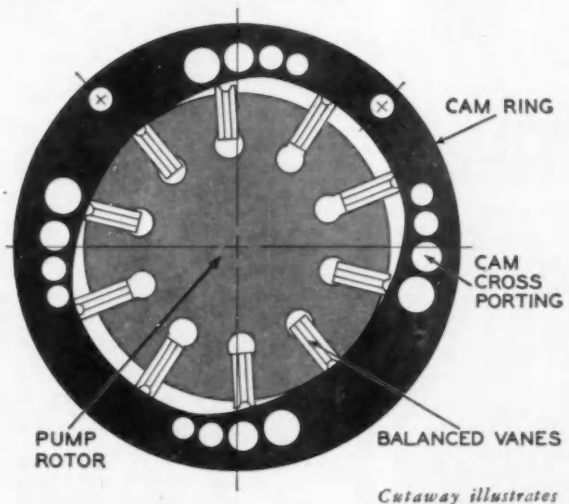
2000 PSI VANE PUMPS

Proper Application
Hydraulic Performance
Operating Characteristics

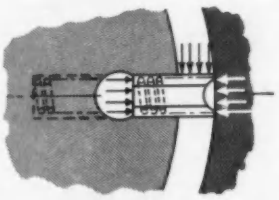
By Ellis H. Born
Chief Application Engineer
Denison Engineering Division
American Brake Shoe Co.
Columbus, Ohio

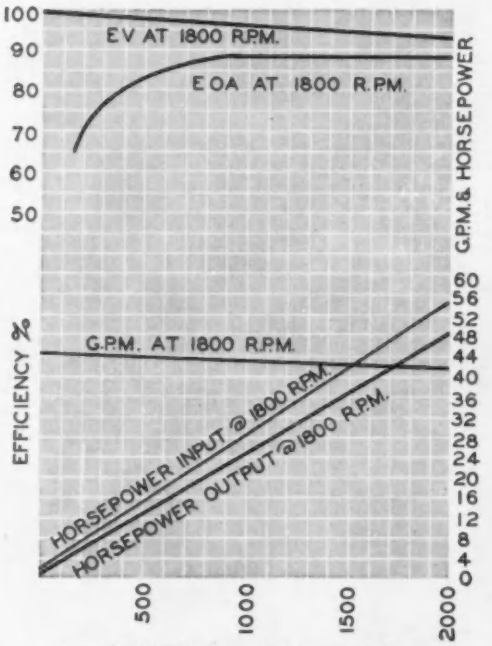
INEFFICIENCIES introduced by line loss are reduced 50% by increasing the pressure from 1000 to 2000 psi.

In designing hydraulic circuits, it is normal to limit line velocities to a maximum of from 15 to 20 feet per second, permitting the use of the smallest practical lines, valves and fittings. The pressure drop in transmitting the fluid medium is thus dependent on flow velocity, number of valves and fittings, and line length. If, for example, the pressure drop of a given system is 50 psi, this would represent a loss in transmission of 5% for a 1000 psi system and a loss of



Cutaway illustrates pump rotor and cam ring assembly. (Below) Pressure balancing relieves hydraulic bearing loads between vanes and cam ring.





Performance Curve of 2000 psi vane type pump illustrates high volumetric efficiency attained with double seal, balanced vane construction.

2.5% for a 2000 psi system. The power lost in transmission is thus reduced 50% by using 2000 psi components.

In sizing components for the transmission of a given horsepower, an interesting comparison of component size, weight and costs can be made. For example, if a job requires the transmission of 16 horsepower, a flow of 16 GPM at 2000 psi working pressure, or 32 GPM at 1000 psi, would be required. Thirty-two GPM would require 1¼" valves, but 16 GPM only ¾" valves. The use of the higher pressure results in a great advantage in that the hydraulic system can be set up with components of lower weight, lower cost per horsepower and smaller, more easily installed pumps, motors and valves.

Additional gains in hydraulic efficiencies are realized by the fully balanced design, not only on the rotor, but on the vanes themselves. Four years of field experience shows that high volumetric efficiencies are maintained over longer periods of service. Wear on cam rings is reduced over conventional designs where the vane is held against the cam ring by hydraulic pressure.

The balanced vane is achieved by a construction allowing the vane to be open at both ends to pressure on the pressure stroke, and to suction on the suction stroke.

Specifications and application data on this vane pump, which also operates as a hydraulic motor, are available by writing.

DENISON ENGINEERING DIVISION
American Brake Shoe Company
1212 Dublin Road, Columbus 16, Ohio

REQUEST FOR APPLICATION DATA

fill out and mail to
DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1212 Dublin Road
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Please send specific data on proper application of vane pumps for my needs. Problem is _____

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Name of Company _____

City _____ *State* _____

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The knowledge and experience gained by Buffalo Bolt in more than 100 years of difficult assignments will assure you the most competent advice in the industry... the most economical service in the fastening field.

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NORTH TONAWANDA, N. Y.

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WESTERN OFFICE	EASTERN OFFICE	CENTRAL OFFICE
Chicago	New York City	North Tonawanda
HArrison 7-2179	REctor 2-1888	JAckson 2400 (Buffalo)

Many **GOOD** *products can be made* **BETTER** *...with* Ⓑ **SPECIAL FASTENERS**

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AUTO REPAIR: E. Cen. Fla. Xlnt. profits. Loc. in prosperous resort area. Equip. Compl. $4,400. Dept 8077.

AUTO ACCESSORIES. W. Fla. Sells nationally advertised brands of appliances, sporting goods, jewelry, etc. Xlnt. profits priced to sell. Dept. 8092.

TIRES, RECAPPING, S. Cen. No. Car. $18,000 profits. A-1 location, Xlnt. building, land, equip. Top franchise. Money-making opportunity. Dept. #8143.

AUTO REPAIRS: So.W. Ga. Net profit $6,500, Bldg. included. Assets worth $8,900. Sales price: $6,500. Lifelong oppty. Dept. 8170.

AUTO ACCESS. & APPLIANCE STORE, N.W. TEXAS. Well established business. Xlnt. location, fully equipped. Good profit picture. Dept. 23723.

MUFFLER SERVICE, W.C. CALIFORNIA. Complete car & truck service. Fully equipped. Well established. Dept. 23726.

GARAGE—W.Cen. ORE. Paint shop, service station. Good location in resort area. All equip. incl. Priced right. Investigate now! Dept. 23757.

BATTERY MFR. So.E. Texas. Mfr. only high grade batteries. Large plant. $106,533 value. F. P. $40,000. Dept. 23772.

AUTO REPAIR, SO. CALIF. Handles all repair work. Location, Los Angeles. Ideal for this type business. Xlnt. profit picture. Owner retiring. Dept. 23796.

AUTO ELECTRIC SERVICE & SUPPLY, NO. CAR., NEW YORK, well established business in Xlnt. location. Full equipment. Dept. 42154.

NEW & USED CARS, S.W. MAINE. Ideal location, easily accessible. Handles also rental units. Xlnt. profits. Opportunity for expansion. Priced right; Dept. 42222.

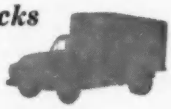
CHAS. FORD & ASSOC. INC., 6425 Hollywood Blvd., Los Angeles, Calif.

BUSINESS FOR SALE: If you are manufacturing or distributing to the automotive trade and want to expand your present line with real proven money-making products. . . . If you are looking for a line that doesn't require much time or work and still earn a steady income. . . . IF you are interested in buying a REAL package deal that includes light machinery, formulas, and a nationally known trade name. . . . THEN this business is the one you want to buy: it is a going concern with nationally advertised products in the auto repair, paint, and reconditioned car field. It has excellent prospects for the future with the right management. Other interests force sale. It will stand rigid investigation, and is offered without the burden of buildings or property. Less than $12,000 is required for a cash sale. Only vitally interested parties will be considered. Please furnish bank, trade or other references with initial correspondence to Grenco Mfg. Co., 11 Byrne Road, West Orange, N. J.

BUY BONDS

Passenger cars

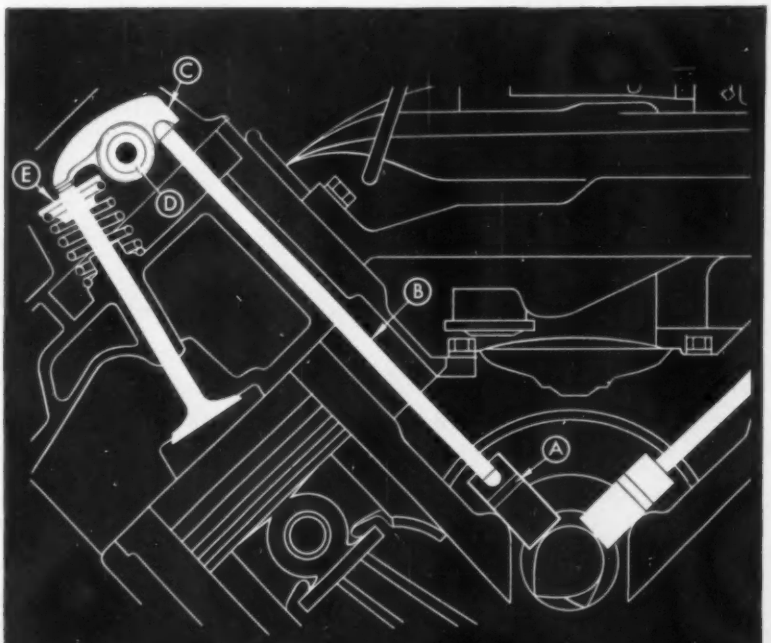
Trucks



Tractors

Diesels

Aircraft



Chicago valve train parts in a typical V-8 automotive engine: (A) Hydraulic tappet, (B) push rod, (C) rocker arm, (D) rocker shaft, (E) valve spring retainer.

When it comes to valve gear, leading engine makers come to

CHICAGO

Here at Chicago you'll find a single source for everything you need in valve gear. These specialized facilities are solving problems and saving money for leading engine manufacturers . . . and can do the same for you.

Design and Engineering—at Chicago you'll find valve gear engineering experience in depth . . . men who understand your problems and will work with your engineering staff in designing cam shafts and complete valve gear assemblies for any type of engine.

Manufacturing—Chicago is a leading manufacturer of valve train parts. Our complete line includes precision-made hydraulic and mechanical tappets; push rods in both lightweight tubular and solid styles; valve adjusting screws including new self-locking screws that cut assembly costs; valve spring retainers; rocker arms and rocker shafts.

Testing—we have complete laboratory and engine testing facilities.

For the full story of how we can serve you, write our Tappet Division.

THE CHICAGO SCREW COMPANY

DIVISION OF STANDARD SCREW COMPANY • ESTABLISHED 1872

2801 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS

(Advertisement)

XVIII

This is the eighteenth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Methods of Carburizing Alloy Steels

Carburizing is a means of impregnating the surface of steel with carbon, usually to very limited depths. Its purpose is to provide a hard, wear-resisting "case," or outer shell. Alloy steels, correctly handled, can be case-hardened without sacrificing desirable core properties.

There are three types of carburizing in general use. These will be discussed briefly in the following paragraphs:

Liquid Carburizing—The medium here is a hot salt bath composed basically of cyanide compounds. The steel is immersed in the bath, the period of immersion depending upon the analysis of the steel and the depth of case desired. Liquid carburizing produces a thin, hard, wear-resisting case with a maximum practical depth range of 0.02 to 0.03 in. When the steel is quenched directly from the bath, distortion is low.

Gas Carburizing—This method employs a furnace in which a carbonaceous atmosphere is created; i.e., gases that are high in carbon components, or those containing carbon. Steel subjected to gas carburizing can be case-hardened to depths generally ranging from 0.01 to 0.04 in. When quenching takes place immediately after carburizing, distortion can be kept to a minimum.

Pack Carburizing—Where the pack method is used, the parts to be carburized are buried in a container of dry carbonaceous materials. The container is sealed tight to prevent the infiltration of air, placed in a furnace and kept there for eight hours or more, the actual time depending upon the depth of case desired. Pack carburizing is particularly suitable where a deep case is essential (0.06 in. and over), although medium cases in the 0.04-to-0.06-in. range are possible.

The carburizing of alloy steels is a highly technical subject, and Bethlehem metallurgists will be glad to help you with any phase of it. Feel free to consult with them about the results to be expected from various analyses and the various methods of treatment. And when you are in the market for alloy steels of any kind, please bear in mind that Bethlehem Steel makes the complete range of AISI standard grades of alloy steels, as well as special-analysis steels and all carbon grades.

If you would like reprints of this series of advertisements from No. I through No. XVI please write to us, addressing your request to Publications Dept., Bethlehem Steel Company, Bethlehem, Pa. The first 16 subjects in the series are now available in a handy 32-page booklet, and we shall be glad to send you a free copy.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

inspection at every stage of manufacture...

A FERRY CAP SERVICE

That Guarantees Special Fasteners Exactly to Your Specifications

At Ferry Cap, special fasteners are thoroughly inspected at each stage of manufacture. And this is only one phase of Ferry Cap's all-inclusive program of quality service.

Right from the beginning skilled engineers and metallurgists stand ready to assist you in designing the best, most economical fasteners for a particular job. In manufacturing, the most modern tools and techniques are used, backed by 50 years of Ferry Cap know-how. Mass production scheduling guarantees fast completion of your order and *on-time* delivery to you.

FASTENER PROBLEM?... if you have a fastener problem we would welcome the opportunity of discussing it with you.

The FERRY CAP & SET SCREW CO.

Pioneers and recognized specialists , cold upset screw products since 1906

2191 SCRANTON ROAD • CLEVELAND 13, OHIO

Creative engineering has long been identified with McQuay-Norris. From this pioneering spirit have come some notable achievements: *phosalloy . . . Chrome-Control . . .* the *400 oil ring.* If our progressive design and production facilities can serve you, we cordially invite your inquiry.

McQUAY-NORRIS

PISTON RINGS . . . HARDENED AND GROUND PARTS

McQUAY-NORRIS MANUFACTURING COMPANY
ST. LOUIS—TORONTO

Typical tire distortion caused by high-speed turn. Tougher, stronger nylon cord tires resist damage from such everyday punishment.

THERE'S EXTRA SAFETY IN NYLON CORD TIRES

Du Pont produces the nylon fiber.
Tire manufacturers make nylon cord tires
—in tubeless or conventional types.

Tires are among the components that can help make today's fine cars even safer. For our roads—whether superhighway or city street—are traveled to a point that tire failure of *any* kind is a potential danger.

- Nylon cord tires offer utmost safety, surest protection against tire trouble. Nylon tires have proved their superiority on military and commercial planes and on heavy-duty trucks. The people whose lives and livelihood depend on the ability of cars to perform at high speeds rely on nylon tires. Turnpike police, professional auto racers and high-speed test drivers are examples.
- Nylon cord tires reduce unsprung weight, and they readily absorb the added strains of power steering, braking, and higher horsepower.
- Nylon cord tires are among the components which contribute importantly to motor-car safety. They are the coming standard of the industry. As original equipment, they provide a valuable sales feature—extra safety.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

DU PONT

REG. U. S. PAT. OFF.

HOW R/M ENGINEERING SETS

R/M
FIRST IN FRICTION

A few of the many friction parts R|M makes of woven and molded asbestos, cork-cellulose, semi-metallic, sintered metal, and other friction materials. Raybestos-Manhattan has been the world's leading maker of friction parts for over 50 years. Unlike other manufacturers, R|M works with all *types of friction materials . . . so that you can be sure of getting a completely unbiased recommendation whenever you consult an R|M engineer.*

THE RECORD OF "FIRSTS" IN FRICTION MATERIAL DEVELOPMENT SHOWS WHY R/M IS FIRST IN FRICTION

FIRST Woven Brake Lining • FIRST Asbestos Brake Lining • FIRST Ground Wearing Surface • FIRST Zinc Alloy Wire Brake Lining • FIRST Pre-Treated Yarns • FIRST Extruded Pulp Brake Lining • FIRST Flexible Pulp Brake Lining in Rolls • FIRST Dry Process Brake Lining • FIRST Semi-Metallic Brake Lining • FIRST Bonded-to-Metal Brake Lining • FIRST Woven Clutch Facings • FIRST Molded Asbestos Clutch Facings for Clutches Operating in Oil FIRST Endless Woven Clutch Facings • FIRST Pre-Treated Clutch Facings • FIRST Bonded-to-Metal Clutch Facings

THE PACE IN FRICTION MATERIAL DEVELOPMENT

R/M

FIRST IN FRICTION

THE TRADE-MARK THAT SPELLS PROGRESS IN FRICTION MATERIAL DEVELOPMENT

R/M alone manufactures all types of friction materials

Particularly with today's more complex requirements, no single type of friction material can be best for all friction applications. That's why R/M (and only R/M) manufactures *all* types of friction material. And that's why you can be sure of getting the material or combination of materials best for you when you consult R/M.

Where asbestos is most practical for your purpose, R/M experience can determine precisely whether woven or molded asbestos parts—or both together—will give you better performance. R/M's experience with asbestos is second to none in the field.

Where kinetic energy absorption per square inch of friction material is very high, where engagements occur on a repetitive cycle with little time interval, or where friction components must be held to a minimum thickness, R/M sintered metal friction parts, for oil or dry operation, may best meet your requirements. Under such severe conditions, R/M sintered metals will perform without appreciable increase in wear rate because of their high thermal conductivity and the absence of a destructible bond.

If high temperatures are not a factor, R/M cork-cellulose materials may give top performance. The most popular type for operation in oil is a composite consisting of a dual-faced assembly with alternately opposed nesting rings of cork and cellulose. The friction properties are at the top of the range. The engagement characteristics are good. And the natural dampening characteristics tend to prevent chatter.

Cork and cellulose materials, however, char to destruction at temperatures close to 400°F. Where higher heat resistance is required, R/M semi-metallic friction materials are widely used. Their durability is much greater than that of resilient types, their engagement characteristics are comparable, but their friction range is lower.

There is some drop-off in friction during the life of semi-metallic materials, but stability of friction under relatively severe operating conditions is one of their recognized advantages. Their versatility is important, too, for they can be made in thin, conformable sections readily adaptable to such uses as bands, plates, cones and intricate shapes.

Woven and molded asbestos, sintered metal, cork-cellulose, and semi-metallic are but five types in the complete R/M line covering all kinds of friction material. Thus, whatever your friction requirements may be—whatever the application—Raybestos-Manhattan is in a unique position to supply the exact friction parts for your purpose.

Remember—next time you have a friction problem—that R/M alone works with *all* friction materials. And remember that all the depth and breadth of R/M experience—the complete facilities of R/M's seven great plants with their research and testing laboratories—are as near as your telephone to help you solve it.

Write for your free copy of R/M Bulletin No. 500. Its 44 pages are loaded with practical design and engineering data on all R/M friction materials.

RAYBESTOS-MANHATTAN, INC.

EQUIPMENT SALES DIVISION: Bridgeport, Conn. • Chicago 31 • Cleveland 16 • Detroit 2 • Los Angeles 58
FACTORIES: Bridgeport, Conn.; Manheim, Pa.; Passaic, N.J.; No. Charleston, S.C.; Crawfordsville, Ind.; Neenah, Wis.
Raybestos-Manhattan (Canada) Limited, Peterborough, Ontario, Canada

RAYBESTOS-MANHATTAN, INC., Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Industrial Rubber, Engineered Plastic & Sintered Metal Products • Rubber Covered Equipment • Asbestos Textiles • Laundry Pads & Covers • Packings • Abrasive & Diamond Wheels • Bowling Balls

Why TDA® is the World's Largest Manufacturer of Driving Axles for Medium and Heavy Duty Commercial Vehicles

In its many years of service to American industry, Timken-Detroit® has produced more than 6,300,000 driving assemblies for powered vehicles (industrial, agricultural or automotive). The "Ten Automotive Firsts" on the opposite page are but a few of the significant results of TDA research and development.

these 10 Automotive Firsts have established TDA® leadership

in producing over

5,000,000

Driving Axles for America's Trucks and Busses

plus 1,300,000 for other powered units!

1. Tandem Driving Axles – TDA developed the first tandem driving axles for the industry to increase the capacity of vehicles.

2. The Double-Reduction Axle (both single and two-speed types) – TDA developed the first double-reduction axles, principally to permit higher axle shaft torque values for nominal pinion input torques.

3. The 3-for-1 Axle – TDA introduced the principle of interchangeability of three optional drives in the same housing . . . single-reduction . . . single-speed double-reduction . . . and two-speed double-reduction.

4. Heavy-Duty Hypoid Gearing – This successful TDA innovation made possible larger, stronger, longer-wearing pinions of greater torque capacity for the same tooth load at the pitch line than corresponding spiral bevel pinions.

5. The Power-Shifted Two-Speed Axle – TDA's power-shift made the two-speed axle universally acceptable. It simplified driver operation, providing improved vehicle control and safety.

6. Unit Mounted "P" Series Power Brake – This highly efficient, compact, easily maintained air brake with lightweight fabricated steel shoes has all parts "unit mounted" on a spider.

7. Tapered Brake Linings – TDA "Econo-Liner" tapered brake linings, first to offer maximum thickness in the area of greatest wear which resulted in uniform thickness when worn.

8. First 100,000 Mile Guaranteed Axle Shaft – Torsion flow forging, controlled gradient hardness heat treating and shrouded spline design make the TDA shaft the best in the industry; first to be guaranteed for 100,000 miles.

9. The Tubular Trailer Axle – TDA adapted the tubular form to trailer axles to make a lighter, stronger axle than any previously available.

10. The "Wide Range" Two-Speed Axle – TDA was the first to develop two-speed axles with ratios of 2 to 1 and 2½ to 1 between the upper and lower ranges, to overcome the basic limitations of mechanical and automatic transmissions.

©1956, R S & A Company

TIMKEN Detroit AXLES

TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN

The Accepted T D A Standard
TRADE MARK REGISTERED

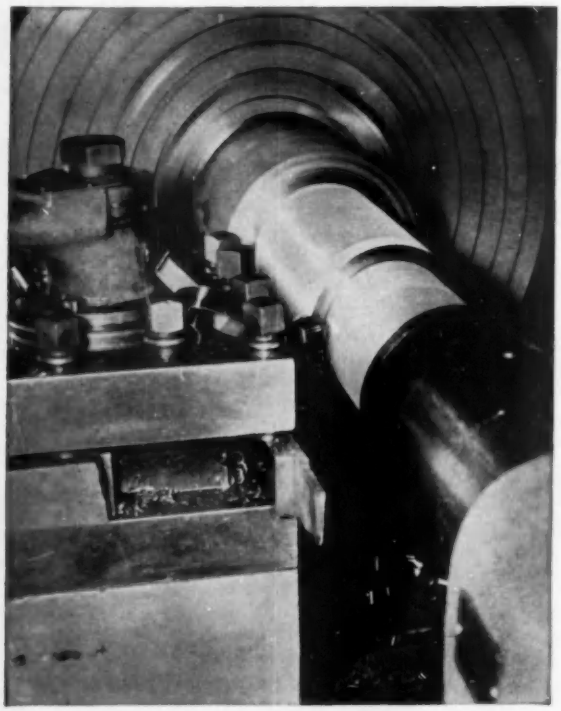
Plants at: Detroit, Michigan
Oshkosh, Wisconsin • Utica, New York
Ashtabula, Kenton and Newark, Ohio
New Castle, Pennsylvania.

WORLD'S LARGEST MANUFACTURER OF AXLES FOR TRUCKS, BUSSES AND TRAILERS

More production for your tooling dollar is the reason...

WHY IT PAYS TO SPEND FOR CARBOLOY EXTRA—

If you rely on "Equivalent Grade" Charts to save a few tooling pennies, these facts on carbide costs may save you thousands of production dollars



TESTS ON STAINLESS STEEL VANED ROLLS by a New Hampshire pulp and paper-processing equipment manufacturer demonstrate how the "Equivalent Grade" Charts hide tremendous differences in carbides' production abilities. With Grade "X," production per tool was limited to two pieces per grind. Machine speed had to be held down to protect the carbide.

Switching to Grade 370 brought the manufacturer 8 to 9 pieces per grind. Machine speeds were doubled; 14 hours a day in labor were saved. Result: savings of more than $100 a week, in addition to lower downtime, grinding, and inventory costs.

SO-CALLED "Equivalent Grade" Charts hide the fact that no two carbide grades will produce the same results. Because they classify carbides by broad areas of application, the Charts ignore important differences in production ability.

Thus, they mislead buyers into believing they can safely purchase the cheapest grade listed for a job.

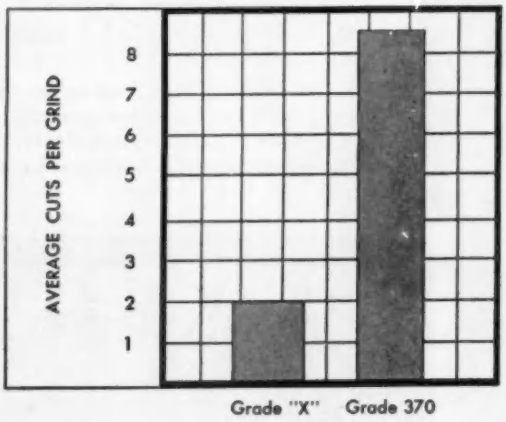
But actual tool-comparison tests have proved conclusively that the production abilities of carbides *do* vary tremendously. Moreover . . . these tests show that the pennies saved by buying on low initial cost often lead to thousands of wasted dollars . . . in lost production, lower machine efficiency, non-productive man-hours.

The case history at left is one of hundreds demonstrating why cost per finished piece – not initial cost – is the only reliable guide to buying carbides.

Results of an actual comparison test

According to the "Equivalent Grade" Charts, any one of several carbide grades could handle the job of machining these rolls. The manufacturer tried Grade "X" first – because it cost 10% less, initially, than Carboloy* Extra-Performance Grade 370.

Grade "X," however, machined only two rolls per day. Grade 370 increased production to 8 or 9 pieces per day (Graph No. 1).

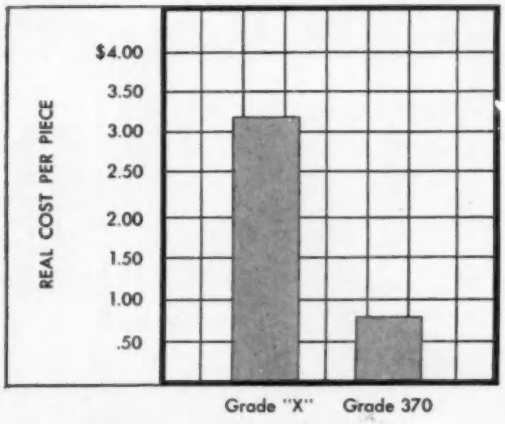


Graph No. 1—Production Ability Comparisons

A FEW CENTS MORE PERFORMANCE CARBIDES

When the *real* cost of the tools was calculated, the manufacturer found the initial saving with Grade "X" was actually *making* him *lose* more than $100 a week. Here's why:

The real cost of Grade "X" was $3.18 per piece machined (2 pieces from a $6.37 tool). The real cost of Grade 370 is just $.82 (average of 8½ pieces from a $7.01 tool). On the weekly production of 42-43 rolls, the saving totals $100.30!



Graph No. 2—Real Cost Comparisons

Yet even this eye-opening figure does not tell the whole story. The Grade 370 tool operated at twice the speed of Grade "X." It helped save the manufacturer 14 hours a day in labor. It provided twice the tool life. It eliminated a special finishing tool.

When these facts were translated into dollars and cents, the manufacturer found that downtime costs were reduced, because the tool remained on the job longer. Grinding costs were reduced, because the tool required less maintenance. Inventory costs were reduced, because a few tools did the work of many.

When added up, these amounted to a considerable saving—yet nothing in the "Equivalent Grade" Charts could have forecast it. These are savings which buying on the basis of initial cost always obscures. These are savings which more than justify spending a few cents more for carbides with extra production ability.

Carboloy Extra-Performance Carbides available for all steel-cutting jobs

Heavy-Duty Grade 370, used in the test above, is one of three Carboloy Extra-Performance Carbides. Together with Medium-Duty Grade 350 and Finishing Grade 330, these grades cover the entire steel-cutting range from roughing to finishing.

Extra-Performance Grades 330, 350, and 370 cost more, initially, because they are made by a unique and more costly process. But their performance so far exceeds conventional carbides that there are actually no "equivalent" grades for any of them. They cannot be fitted into the arbitrarily selected cubbyholes on the "Equivalent Grade" Charts now in common use.

These Extra-Performance Grades easily expose the fallacy of the "Equivalent Grade" Charts, because they are so superior to other steel-cutting grades. But even when attempting to classify conventional grades, the Charts exhibit the same fatal flaw.

Because there is no way of knowing in advance how any grade will perform on the job, we make this suggestion: Always run your own comparison tests *before* you specify a grade. When the results are in, you will find that one grade will bring your plant significant savings in tool costs, machining and labor expense.

We think you will find *that grade* will be one of the Carboloy Extra-Performance Carbides. But whatever it is, specify it *by name*. Do not settle for an "equivalent" grade.

If you would like a more detailed discussion of the whole problem of Initial Costs vs. Real Costs, and the fallacies of the so-called "Equivalent Grade" Charts, write today for a sales engineer to call on you. Send your request to: *Metallurgical Products Department of General Electric Company, 11151 E. 8 Mile Street, Detroit 32, Michigan.*

CARBOLOY

CEMENTED CARBIDES

*CARBOLOY IS A TRADEMARK OF GENERAL ELECTRIC COMPANY

THIS SINGLE-FLANGE TRACK ROLLER IS FORGED

in three blows

BLOW ONE

BLOW TWO

BLOW THREE

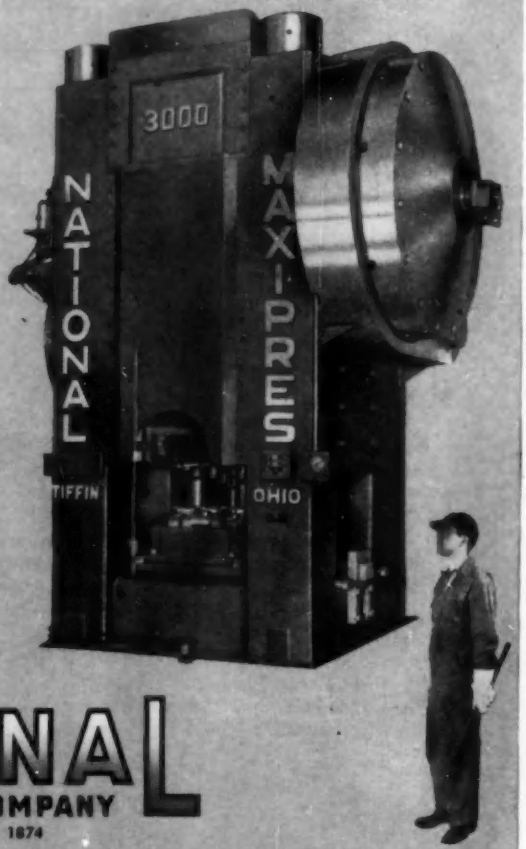
ON A NATIONAL 3000-TON MAXIPRES!

J. H. Williams & Co., Buffalo, N. Y., forges this difficult Caterpillar Diesel Tractor part in 22 seconds on a National 3000-ton MAXIPRES.

Steel stock weighing 45 pounds is conveyed from the furnace to a position in the press convenient to the operator. Finished forgings are then conveyed to the trimming press where flash is removed.

Progressive, experienced forgers, J. H. Williams & Co. relies upon MAXIPRESSES for an important part of its output.

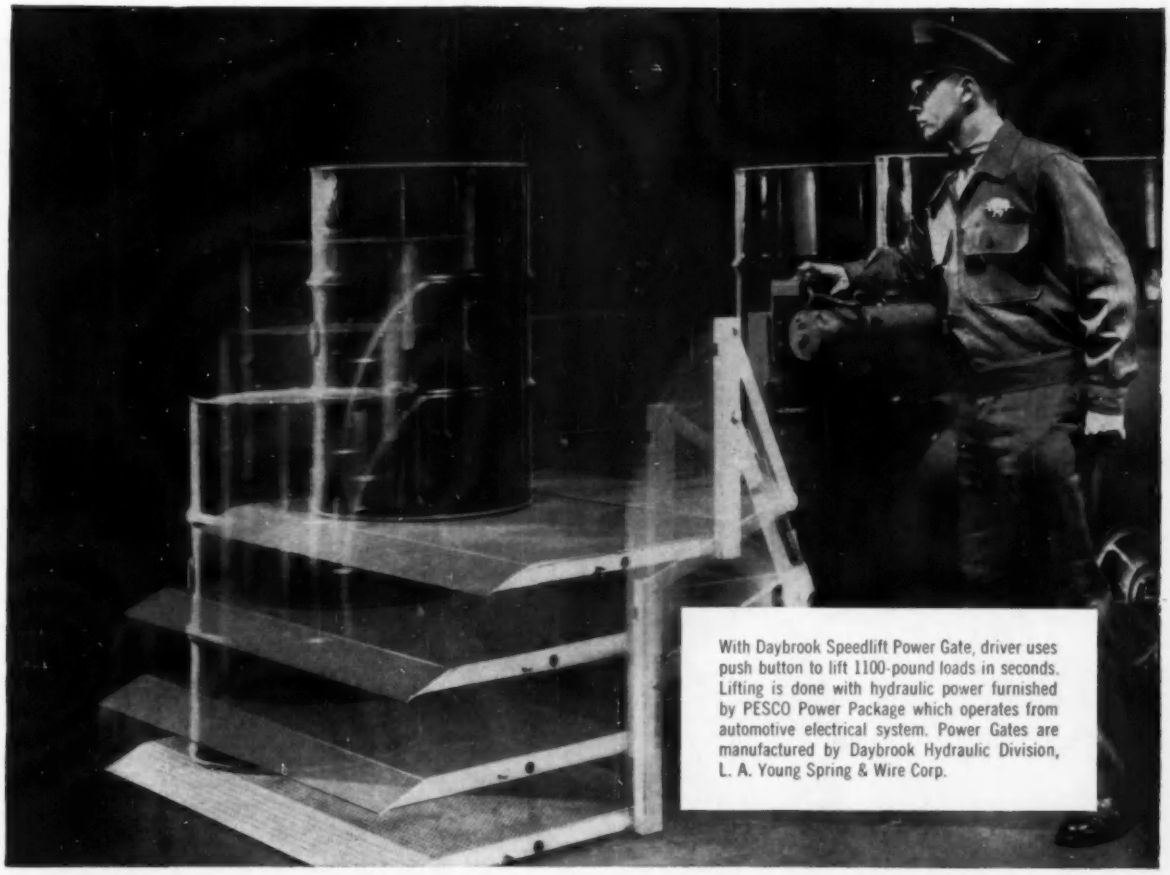
If your problem is to make metal parts faster, stronger, and at lower cost, let us help you solve it. Send us your prints and samples, or, better yet, pay us a visit. No obligation!



NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO — SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

Hartford Detroit Chicago



With Daybrook Speedlift Power Gate, driver uses push button to lift 1100-pound loads in seconds. Lifting is done with hydraulic power furnished by PESCO Power Package which operates from automotive electrical system. Power Gates are manufactured by Daybrook Hydraulic Division, L. A. Young Spring & Wire Corp.

hydraulic power at the push of a button

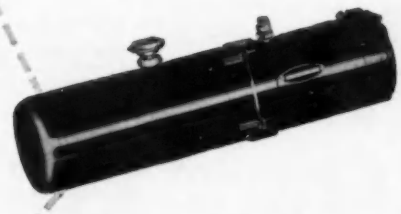
...with self-contained Pesco package

If you need to produce hydraulic power from an electrical source, investigate Pesco's line of Hydraulic Power Packages.

These low-cost units are versatile and find extensive application on tailgate loaders, lift trucks, small dump bodies, farm tractors and snow plows. They provide hydraulic flow to .80 gpm at pressures to 2000 psi from any suitable 6, 12 or 24-volt d-c source.

Pesco Hydraulic Power Packages include an electric motor, hydraulic gear pump with integral relief valve, check valve and reservoir in a single, self-contained assembly. The Pesco gear pump features "Pressure Loaded"* bearings for higher volumetric efficiency and longer service life.

Original equipment manufacturers are invited to obtain price quotations or specific information from your nearest Pesco sales engineer or write: Pesco, 24700 North Miles Road, Bedford, Ohio.



PESCO HYDRAULIC POWER PACKAGE converts electrical power to hydraulic, finds wide industrial use. Compact "package" design contains motor-driven gear pump, relief and check valves and reservoir.

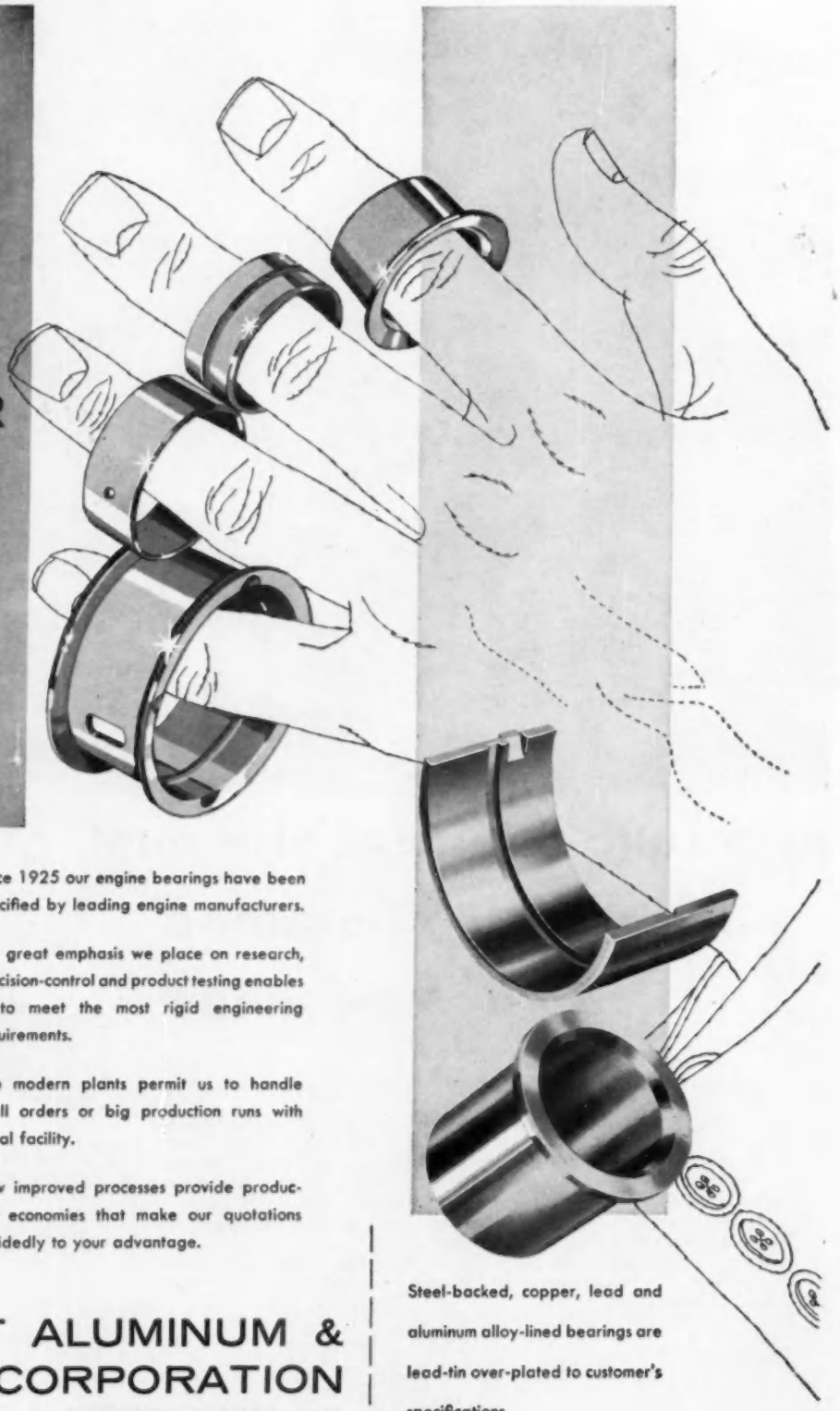
See our catalog in Sweet's Product Design File

PESCO PRODUCTS DIVISION
BORG-WARNER CORPORATION
24700 NORTH MILES ROAD • BEDFORD, OHIO

Producing the Best in Hydraulic Pumps, Fuel Pumps, Electric Motors and Axial Flow Blowers

**PESCO's patented principle of gear pump construction*

4 THINGS TO REMEMBER THE NEXT TIME YOU BUY ENGINE BEARINGS



1. Since 1925 our engine bearings have been specified by leading engine manufacturers.
2. The great emphasis we place on research, precision-control and product testing enables us to meet the most rigid engineering requirements.
3. Two modern plants permit us to handle small orders or big production runs with equal facility.
4. New improved processes provide production economies that make our quotations decidedly to your advantage.

Steel-backed, copper, lead and aluminum alloy-lined bearings are lead-tin over-plated to customer's specifications.

DETROIT ALUMINUM & BRASS CORPORATION

DETROIT 11, MICHIGAN

Plants at Detroit, Michigan and Bellefontaine, Ohio

Your source for BIG Cap Screws for big jobs

...Cleveland's *Top Quality*

EXTRA LARGE SIZES

Modern developments in things of massive size—earth moving and road building machinery, hydraulic equipment and other unusually large assemblies—have increased the need for extra large Cap Screws.

Anticipating this demand, Cleveland will install the world's largest Boltmaker which will produce *in volume,* cap screws up to 1¼″ x 10″.

Every day we're shipping diameters up to 2½″, in lengths as required. Occasional special orders call for greater diameters, even up to 4 inches. Of course, size alone doesn't always provide required physical properties. Close attention to steel selection, testing and preparation, strict control throughout manufacturing processes, and final critical inspection assure you cap screws of *known strength* as well as brute size.

Physical properties of Cleveland Cap Screws in various styles up to 2½″ diameter are shown on our handy chart. Write or wire for delivery and price information on extra large Cap Screws.

The Cleveland Cap Screw Company

2955 East 79th Street • Cleveland 4, Ohio • VUlcan 3-3700 TWX CV-42

Warehouses: Chicago • Philadelphia • New York • Providence • Los Angeles

Photo courtesy of Caterpillar Tractor Co., Peoria, Ill.

it's only part of the HTM* story . . .

STRENGTH

High ultimate strength of HTM castings helps the famous Cat D7 Tractor do the tough jobs day-in and day-out. Vital parts, such as the front idler adjusting nut shown, are made from HTM metal . . . the metal with the high ultimate strength that resists wear and fatigue under heavy loads.

And there are lots of other "plus" advantages in HTM castings. For example, they possess excellent non-seizing properties . . . can be either liquid or air-quenched . . . can be given a smooth finish. Perhaps *most important of all, HTM machinability index ranges from 80 to 90 (B1112 steel = 100).*

HTM castings can often reduce manufacturing costs, weight and assembly time . . . can increase quality and sales potential of *your* product. AA-3716

***HTM**—*High Tensile (Heat-Treated) Malleable*

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

Established 1868 • Cleveland 6, Ohio

the nation's largest independent producer of malleable and pearlitic malleable

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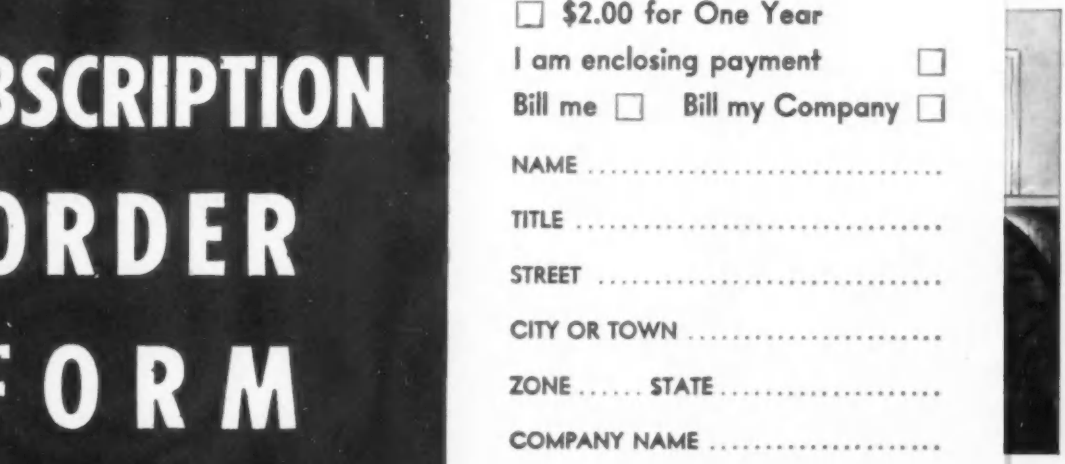

you "produce more at lower cost."

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Greenlee's adequate facilities expedite the transition from production ideas to production machines . . . a profit-making investment at work in your plant.

Greenlee 10-Station Automatic Transfer Machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

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YOU *MUST* HAVE

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PRECISION WEIGHT!

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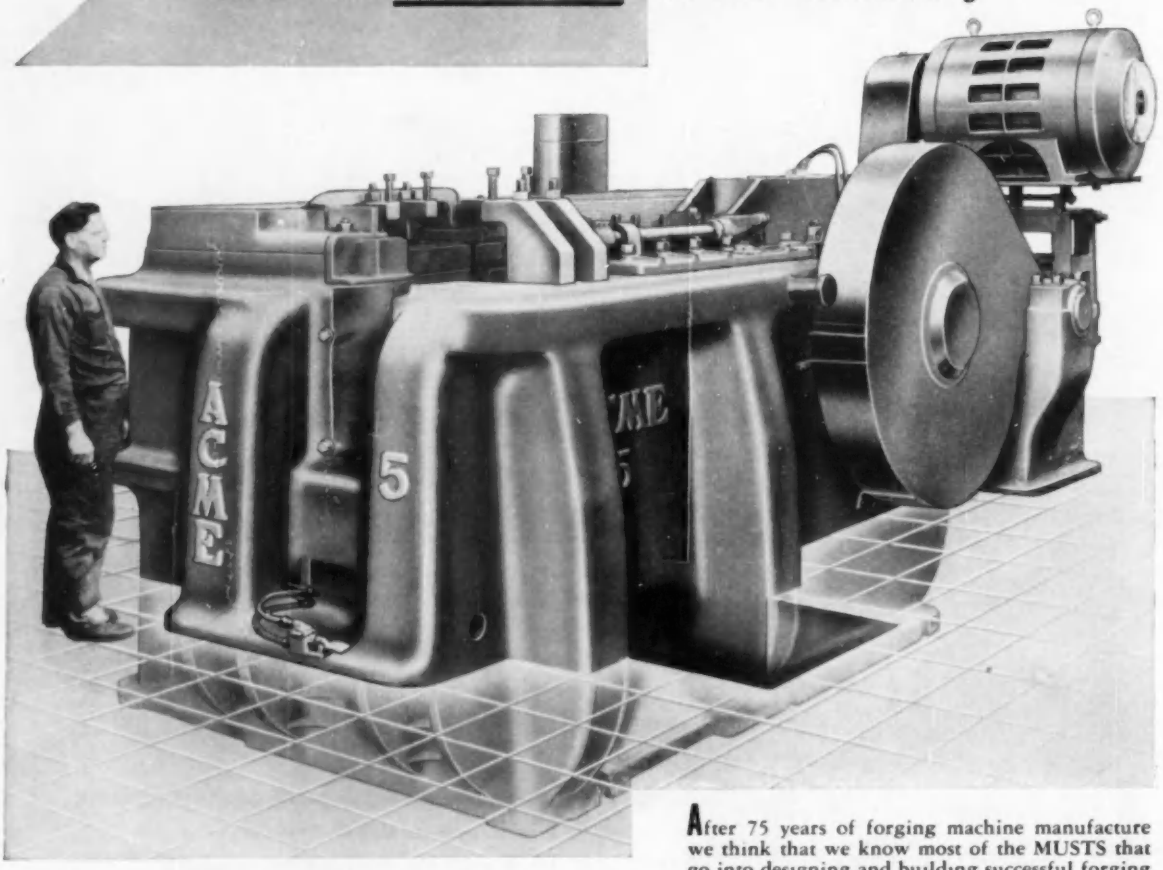

5" ACME XN

OVER 100 TONS of CONTROLLED PRECISION

After 75 years of forging machine manufacture we think that we know most of the MUSTS that go into designing and building successful forging machines. One of those MUSTS is WEIGHT. Only recently we have added still more strength in one or two spots on ACME XN Forging Machines where greater rigidity will insure still greater accuracy and long term trouble-free operation. If you do not have the latest facts on ACME XN Forging Machines we invite you to determine for yourself just what progress has been made in modern forging machine equipment. *Bulletin 956 tells the story.*

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ACME MACHINERY DIVISION
ESTABLISHED 1882
1209 W. 65th St., Cleveland 2, Ohio

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

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O-M Tie-rodless (round line) Air and Hydraulic Cylinders rated to 500 psi Air; to 1500 psi Hydraulic.

O-M CYLINDERS
TIE-RODLESS

• SMOOTH • POWERFUL • DEPENDABLE

air and hydraulic meet JIC standards

O-M Tie-rodless Air and Hydraulic Cylinders deliver peak performance at low or high speeds. They are simple and unique in design . . . have no tie rods or projecting end caps . . . fit easily in unusually close quarters . . . operate with lowest co-efficient of friction . . . and are readily disassembled for servicing. Besides, the ports can be oriented to any position. Interchangeable mounts make O-M Cylinders adaptable to any installation. All cylinders tested at rated operating pressures before shipment.

Available in full range of sizes (1½" to 8" bores) with standard, 2 to 1 or oversize rods.

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for Bulletin 101A, showing all cylinders, mounts and mounting brackets.

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☐ Have Representative call ☐ Send Bulletin 101A (Round Line)

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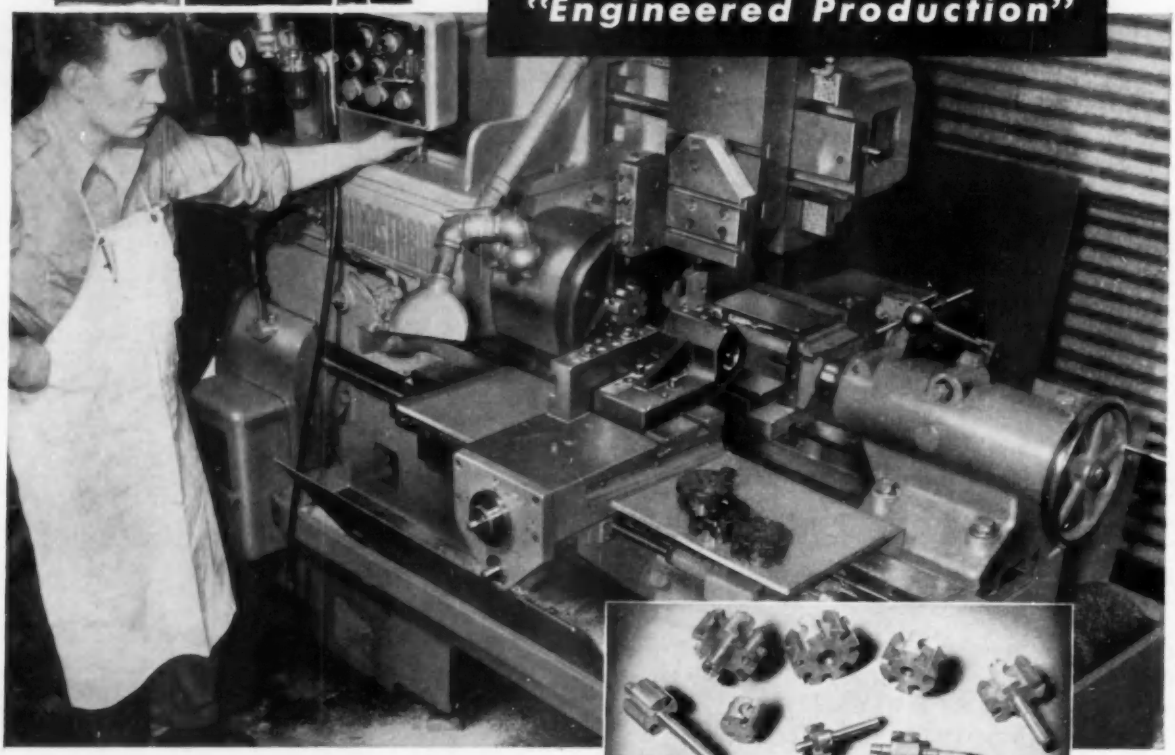
Before You Buy ANY Turning Equipment Check What You Get From

SUNDSTRAND

"Engineered Production"

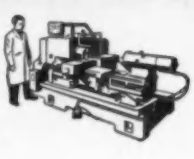


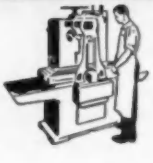
For Instance This Sundstrand Automatic Lathe Increased Production 2½ Times

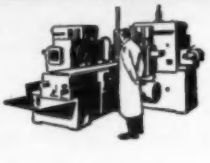
Here's a small lot turning job done on a Sundstrand Model 8A Automatic Lathe. Pump rotors and covers are turned and faced in lot sizes of 100 to 500 pieces. Previously these parts were run on 3 different conventional turning machines using 3 operations. With this Sundstrand Automatic Lathe, the same amount of work is done 2½ times faster.

SUNDSTRAND *"Engineered Production" Service** *REG. U.S. PAT. OFF.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS







WHY SUNDSTRAND CAN OFFER ECONOMICAL SOLUTIONS TO PRACTICALLY ANY TURNING JOB

Many years of designing machine features to increase production and lower costs on all classes of turning problems has provided Sundstrand with the experience to design and build equipment for practically any turning job. A few of the diversified types of Sundstrand tooling and equipment provided for different turning problems are shown on this page.

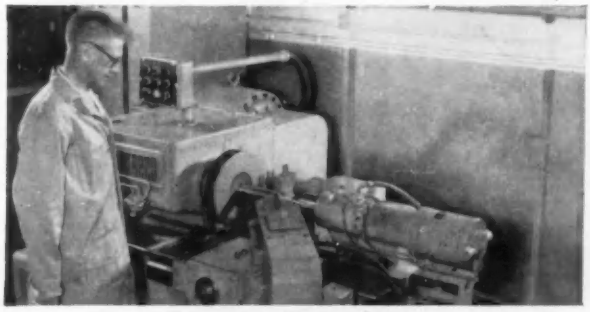
Automatic Tool Resetting

Self compensation for tool wear and automatic replacement of tools worn to a predetermined limit have been built into the Automatic Lathe shown above. Lathe can run approximately an 8 hour shift without attention, except for an occasional check by operator to make sure parts are being delivered to the loading mechanism.

Although the lathe shown above is for turning motor rotors the principle of automatic tool re-setting has been applied to Sundstrand Automatic Lathes for other types of jobs.

How to get the right machine for your work

Investigate the many services and physical equipment available from Sundstrand "Engineered Production." Call in a Sundstrand engineer, or write for bulletin 274. There is no obligation for this service.

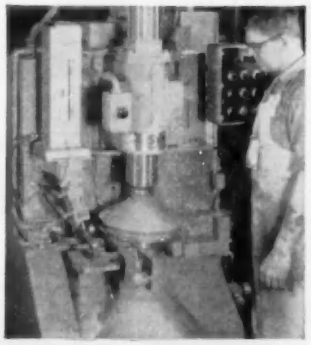


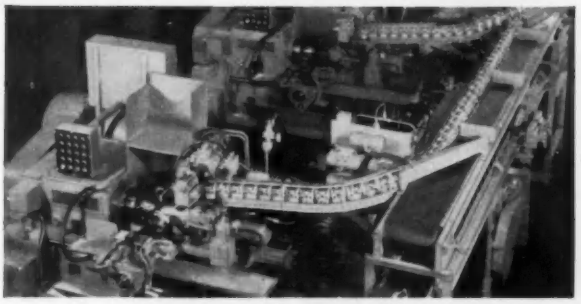
Tracer Turning

For multi-cycle single point turning of irregular shapes, Sundstrand Automatic Lathes can be provided with a template controlled tracing slide that replaces the regular front carriage. With this tracing slide and controls, ruff, semi-finish and finish cuts can be taken with one turning tool in an automatic cycle. The regular rear slide can be used to square up shoulders, chamfer, etc.

Vertical Turning

Here's the Sundstrand Vertical Lathe of a simplified basic design easily adapted to production work. Shown here, it bores, polishes and gages the ID of brake drums. Machine is easily arranged for turning, grooving, or tracer applications.

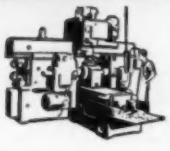


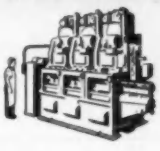


Automatic Loading

Here's one of the many automatic loading and unloading units designed for Sundstrand Automatic Lathes to handle a specific part. Units of this type simplify machine operation and provide a complete automatic cycle for high production.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





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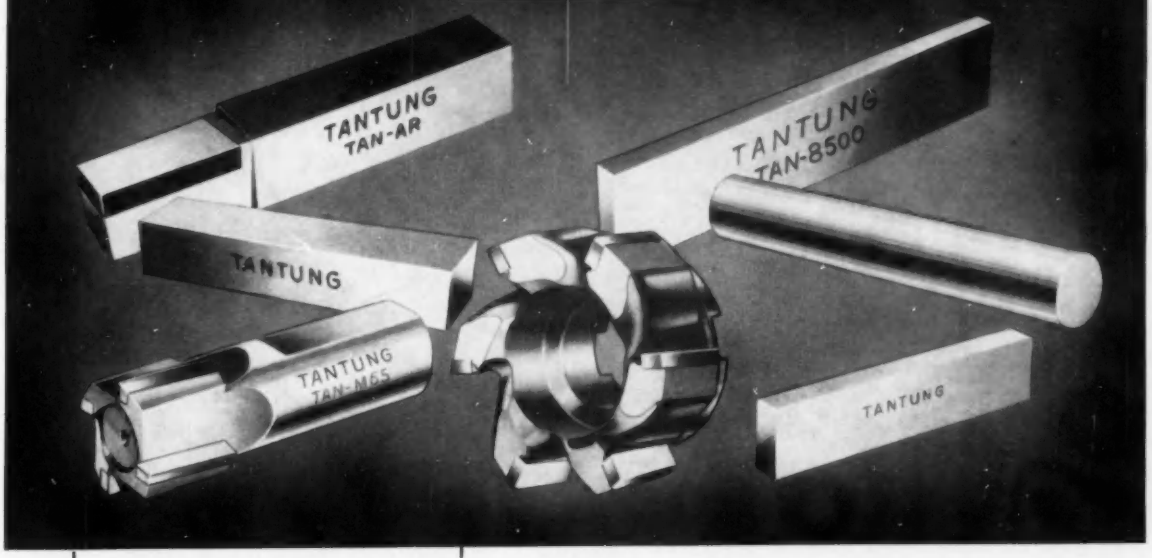
V-R TANTUNG CAST ALLOY

cuts twice as fast as High Speed Steel



Facts You Should Know About TANTUNG, V-R's *Exclusive* Cast Alloy:

- **TANTUNG CONTAINS CARBIDES**—of tungsten, tantalum and columbium. This combination gives it superior toughness and lower friction coefficient than ordinary cast alloys.
- **TANTUNG IS STRONGER**—transverse rupture strength double of most cast alloys.
- **TANTUNG HAS HIGH RED-HARDNESS**—it maintains cutting hardness at red heat temperatures well above that of high speed steel.
- **TANTUNG IS EASY TO GRIND**—aluminum oxide wheels used for hardened steel are suitable
- **TANTUNG IS AVAILABLE PREFORMED**—when you buy preformed tools, you save grinding costs and get better cutting quality and longer tool life.

When Tooling AUTOMATICS— Don't Overlook TANTUNG!

V-R and TANTUNG are registered trademarks of Vascoloy-Ramet Corporation.

High Red-Hardness — Plus Low Friction

lets you speed up your machines and cut your costs . . .

As a general rule, when using TANTUNG cast alloy cutting tools, you start your machines at about twice the speed you would use with high speed steel tools. TANTUNG bridges the gap between the maximum speeds possible with high speed steel and the minimum speeds practical with cemented carbides. Its general cutting range lies between 80 and 180 surface feet per minute, subject to some variation according to machining operation and material being cut.

And, TANTUNG is at its best under heavy feeds!

Here is a typical example:

JOB: Recessing high alloy steel ring gear forging on Potter and Johnson Semi-Automatic.

	H.S.S.	TANTUNG
Speed:	94 R.P.M.	165 R.P.M.
Feed:	.004"	.008"
Depth of cut:	.125"	.125"
Pieces per grind:	35	70
Av. pieces per shift:	38	100

. . . more than 2½ times production increase!

If you want to reduce costs and increase productivity, take a good look at TANTUNG.

GET ALL THE FACTS in this 24-page free catalog containing charts, tables, recommendations and data. Send for yours today.

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Nonskid, light, corrosion resistant

Alcoa® Abrasive Tread Plate is a strong aluminum alloy with gritty aluminum oxide rolled into the surface.

It's so nonskid you can walk right up a 30° incline, even when it's wet, greasy or covered with oil!

This tread plate won't lose its grip. Wearing it down simply exposes more rolled-in grit! It's two-thirds lighter than steel. It comes in many sizes and thicknesses. It's easy to punch, cut, form, weld, shear, etc.

THINK—Where can you use this light, corrosion-resistant tread plate? It's ideal for factory floors, ladder treads, train vestibules, plates, truck trailers, marine decking, elevator floors and sills and many other uses. See your Alcoa distributor.

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Please send free sample of *Alcoa Abrasive Tread Plate* and informative 8-page booklet.

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THIS *PAASCHE* GUN IS A MASTER PAINTER'S DREAM

A Gun That Inspires Full Pride In Workmanship

PERFECT BALANCE: The Paasche Model 21 has a compact head, a generous two-finger trigger with easy pull and a comfortable handle — all in perfect balance.

INFINITE SPRAY PATTERN ADJUSTMENT: The new dual purpose air valve permits the use of air from horn holes only, center air cap holes only, or an intermixture of any proportion from these sources. The atomizing air control and the fan control afford infinite pattern adjustment with a minimum number of air caps.

BUILT FOR HEAVY USE: The one-piece heat-treated aluminum forged shell can really take abuse. Tough, durable anodized finish with chrome-plated drop forged brass fluid body make this a handsome gun that will not show wear. All internal metal parts are stainless steel. Teflon packing materials are self-lubricating, will not dry out.

ECONOMY OF OPERATION: Large, unrestricted air passages of short travel through the gun assure high volume of air atomizing even the heaviest materials at lower pressures.

EASY MAINTENANCE AND SERVICING: Gun body is well-rounded and highly polished making it easy to wipe clean. Cartridge type air valve assembly is easily removed for repair or replacement if ever required.

CONSULT YOUR CLASSIFIED DIRECTORY FOR NEAREST PAASCHE REPRESENTATIVE OR WRITE FOR INFORMATIVE BULLETIN.

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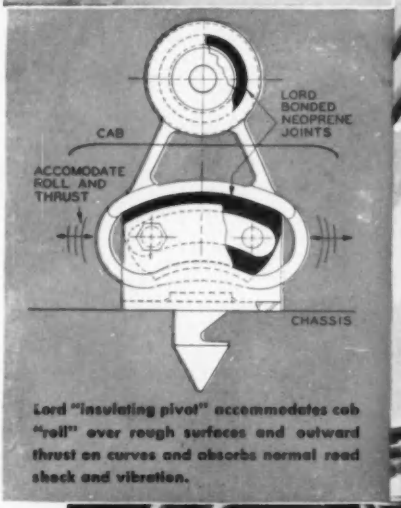
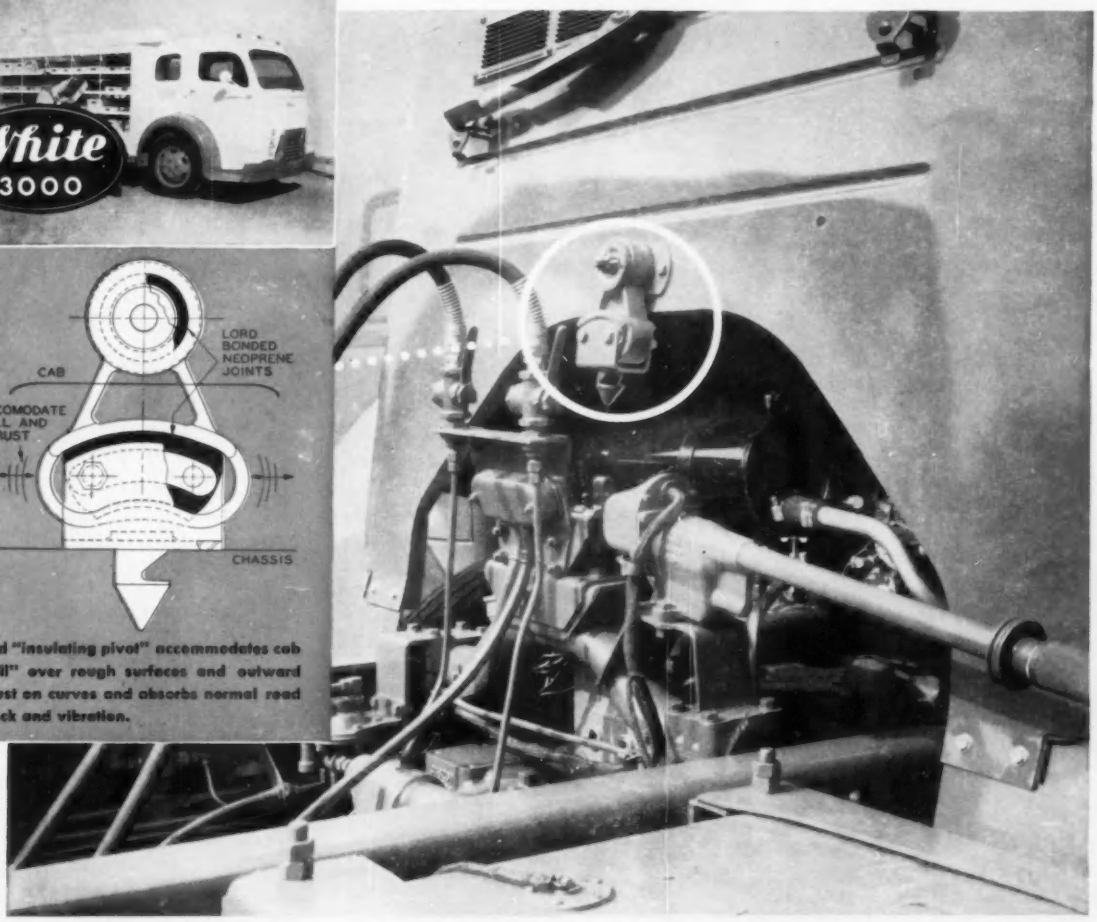


Lord "insulating pivot" accommodates cab "roll" over rough surfaces and outward thrust on curves and absorbs normal road shock and vibration.



LORD "insulating pivot" contributes to smooth ride of WHITE tilt cab

The unique power-lift cab feature of White 3000 Series Trucks required a connecting device to anchor the rear of the cab to the vehicle frame. Such a device must combine high strength with resiliency to provide smooth, noiseless riding.

White called on LORD Vibration Control Engineers to tackle the problem. LORD's solution was an "insulating pivot"—a rugged bonded rubber mounting which absorbs road noise and cab motion—and requires no maintenance.

As a result, White has used these LORD mountings for four years as standard equipment without a single failure reported. This LORD Mounting replaced an all-metal sliding link which was subject to excessive rattling, costly maintenance and frictional wear.

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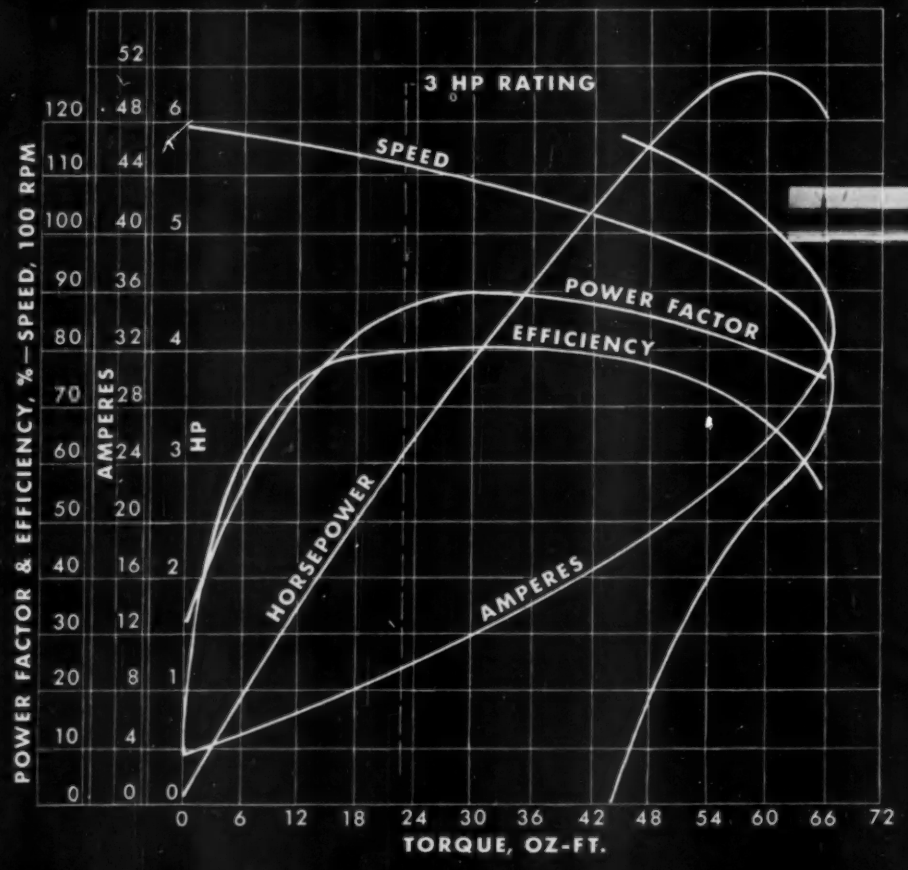

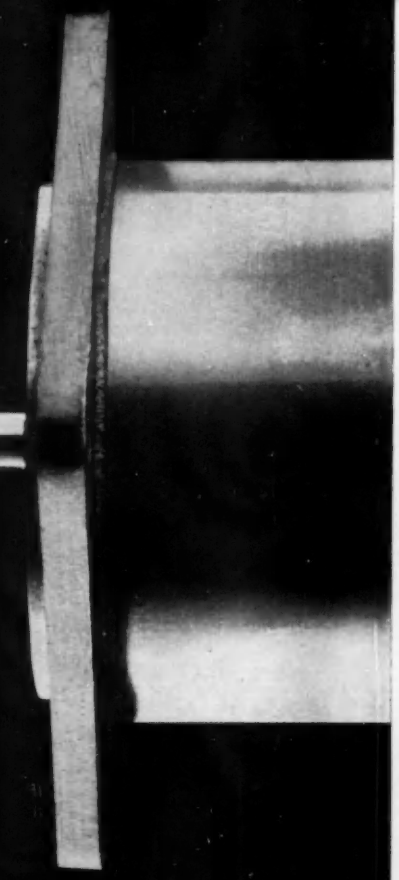

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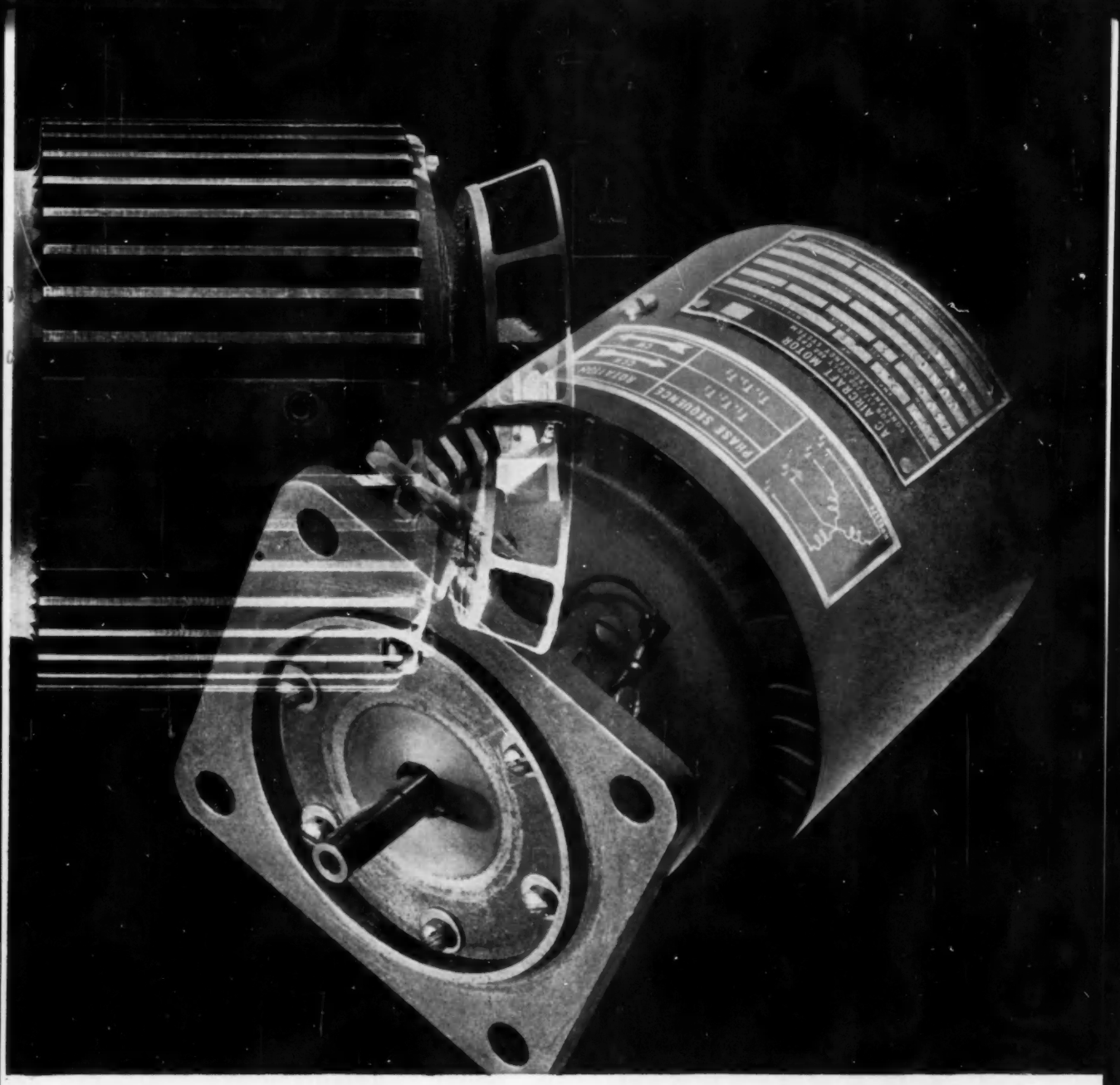
Dependable drive power . . . from sea level up. That's what you get with the new line of Westinghouse 400-cycle, a-c motors. Ranging from 1/30 hp to 30 hp, the power-to-weight ratio of these motors is unequaled by any on the market. *A 4-inch-diameter frame delivers 3 hp at continuous duty and weighs only 10½ pounds!* Unique design keeps temperature rise extremely low in spite of the small size.

These new a-c motors meet the general requirements of MIL-M-7969A. They are designed to drive aircraft-type fans, pumps,



compressors, blowers and actuators. They are totally-enclosed or through-ventilated, self-cooled and explosion-proof. Locked bearing construction gives longer bearing life when subjected to shock and vibration. Simplicity of design permits easy maintenance.

Westinghouse engineering and experience is available to you now to solve your motor problems. For complete information call your Westinghouse sales engineer or write: Westinghouse Electric Corporation, Aircraft Equipment Dept., Lima, Ohio.

J-03032

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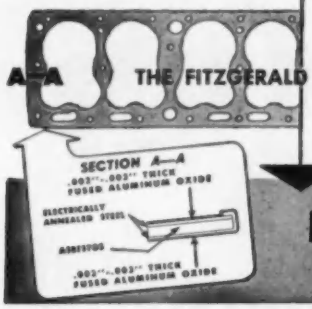

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FINEST *to the* COARSEST
IN PERFORATED METALS
AND WIRE CLOTH

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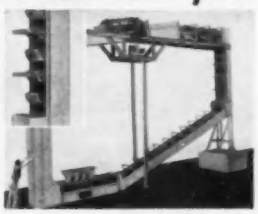
Hapman Tubular Conveyors move almost any bulk material—wet or dry—through any plane or angle. They're dust, liquid and odor-tight. Investigate!
WRITE for Bulletin T-G126.



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760 West Polk Street, Chicago 7, Illinois

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Produced economically in our modern plant for:

AUTOMOTIVE, INDUSTRIAL EQUIPMENT, AIRCRAFT, AGRICULTURAL INDUSTRIES AND OTHERS; will boost your output at material savings.

Our production, engineering and tool-room facilities are geared to the volume usage of *your* industry.

Send us your inquiries

LANSING STAMPING COMPANY

1157 So. Penn. Ave.
Lansing 2, Michigan

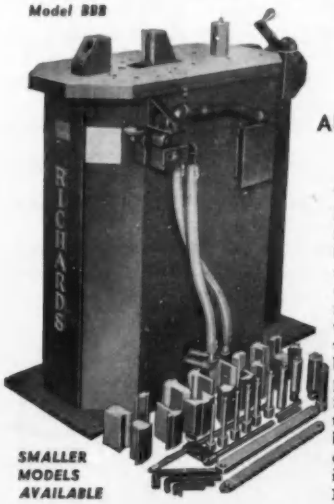
Serving Industry Since 1914

Multiform

BIG BROTHER BENDER

Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender.

Model BBB



SMALLER MODELS AVAILABLE

AIR OPERATED MODELS IN FOUR SIZES

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches — punching and blanking dies extra. Will punch holes up to 1" and form material up to ¼" thick by 4" wide. We also build smaller models, hand or air operated, for bending materials up to ⅜" x 1½".

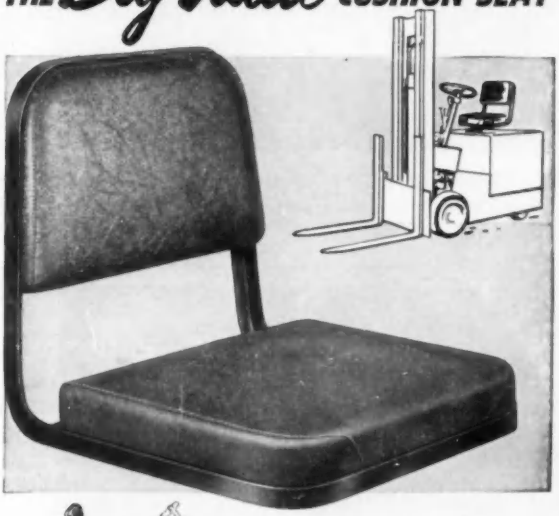
Send for illustrated folder AMI-2

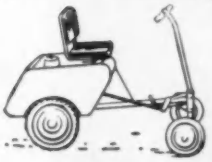
J. A. RICHARDS CO. 903 North Pitcher St. Kalamazoo, Mich.

CONTOUR
Milsco
MILWAUKEE
SEATING

Thrift-King

THE *Big Value* CUSHION SEAT





For POWER MOWERS, LIFT TRUCKS AND OTHER MEDIUM MOBILE EQUIPMENT

"Thrift-King" is a 2-way value seat for manufacturers of lift-trucks, mowers, and many types of medium mobile equipment: it definitely adds "sell;" it definitely improves workability. Full cushion foam rubber seat and full cushion foam rubber back rest assure sustained comfort and operational freedom. Wide choice of covering materials that will withstand outdoor use. Frame is of solid one-piece welded construction for rigorous service; easily attached. Available as illustrated, or with special features engineered to your equipment.

Write for complete information on America's finest line of cushion seating — Milsco.

MADE TO FIT YOUR NEEDS

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FACTORY AND MAIN OFFICE
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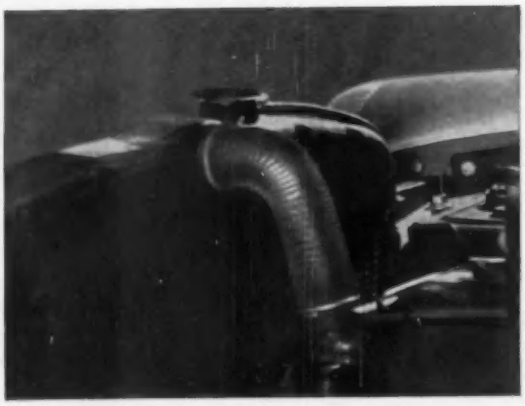
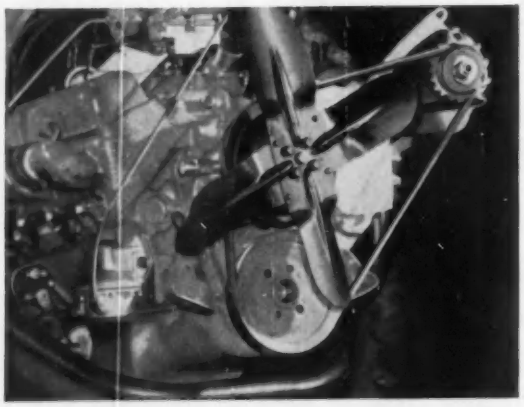
SALES OFFICES: Tom Riley, 67 Long Lane, Upper Darby, Pa
E. M. Wilson Engineering Co. 915 Meridian Avenue South Pasadena, Calif.
Harlan C. McKay Company 1901 N. W. 26th Avenue Portland 10, Oregon

Milsco MILWAUKEE

Specialists in Cushion Seating



RADIATOR HOSE takes higher pressures, resists stretching far better when reinforced with strong-as-steel Fortisan-36.



V-BELTS with Fortisan-36 present no problem of stretching or contracting under atmospheric changes or "work." Makes it easy to match belts.

HYDRAULIC HOSE reinforced with Fortisan-36 are lighter but stronger for reliable power transmission. Retains dimensional stability under heat.

For extra strength and low stretch... Fortisan-36 Rayon

Radiator hose, V-belts and hydraulic hose stand up to the toughest operating conditions when they're made with Fortisan-36 rayon fiber. This remarkable new Celanese development is fast becoming a leading contender for the heavy-duty title.

Fortisan-36 is a high-tenacity rayon of saponified acetate that combines unprecedented strength with minimum elongation and near-perfect dimensional stability. It's the easiest way to make a product stronger for the same weight . . . or lighter for the same strength. Write for the complete story on sensational new Fortisan-36 (ask for booklet TD 20A) to Celanese Corporation of America, Industrial Sales Dept., Textile Division, Charlotte, N. C. *Branch offices:* 180 Madison Ave., N. Y. 16; 22 W. Madison St., Chicago 2, Ill.; 140 Federal Street, Boston 10, Mass.

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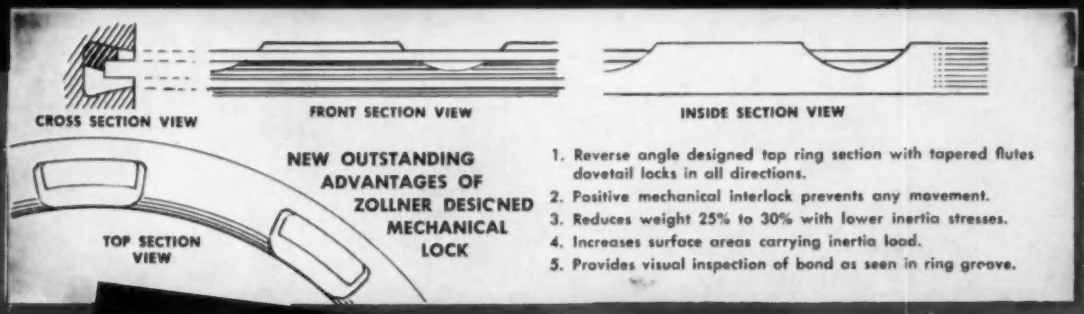
Fibers for Industry

ARNEL® TRIACETATE FORTISAN® RAYON FORTISAN®-36 RAYON ACETATE VISCOSE-RAYON

BOND-E-LOC* PISTONS

WITH "NI-RESIST" IRON TOP RING SECTION


CROSS SECTION VIEW
FRONT SECTION VIEW
INSIDE SECTION VIEW
TOP SECTION VIEW
NEW OUTSTANDING ADVANTAGES OF ZOLLNER DESIGNED MECHANICAL LOCK
1. Reverse angle designed top ring section with tapered flutes dovetail locks in all directions.
2. Positive mechanical interlock prevents any movement.
3. Reduces weight 25% to 30% with lower inertia stresses.
4. Increases surface areas carrying inertia load.
5. Provides visual inspection of bond as seen in ring groove.

Double Bonded

METALLURGICALLY Al-Fin Bond

MECHANICALLY Zollner Lock

STOPS!

RING GROOVE WEAR IN HEAVY DUTY SERVICE

"Sensational mileage" is the unanimous report of heavy duty engine builders and transport operators using Zollner "Bond-O-Loc" Pistons. Another great development by Zollner engineers, this super-mileage piston has a "Ni-resist" top ring groove section *permanently* incorporated with the *double* bond of *both* Al-Fin metallurgic *and* the exclusive Zollner mechanical lock. Separation failure is impossible. Ring groove wear problems are eliminated, blow-by prevented, oil consumption minimized, mileage to overhauls greatly increased. We suggest an immediate test of these sensational advantages for your engine.

Licensed under Patents 2,396,730; 2,455,457; 2,550,879

*T. M. Reg. Pat. App. For

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PRECISION PRODUCTION

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THE ORIGINAL EQUIPMENT PISTONS

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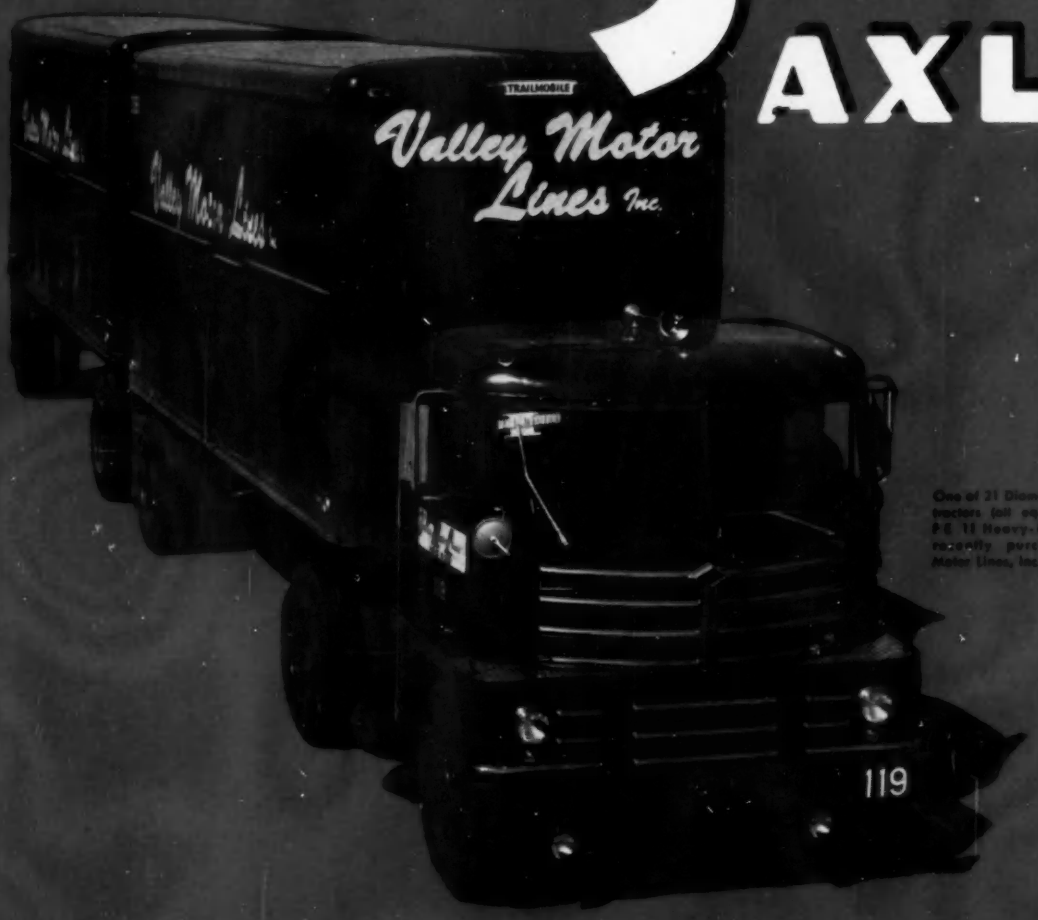
DIAMOND T

USES

SHULER AXLES



One of 21 Diamond T Tilt-Cab diesel tractors (all equipped with Shuler PE 11 Heavy-Duty Front Axles) recently purchased by Valley Motor Lines, Inc., Fresno, California.

THERE ARE NO BETTER AXLES, AT ANY PRICE!

Since 1915, Manufacturers of: *One-Piece* Tubular Heavy-Duty Trailer Axles; Front Axles for Trucks, Busses, and Off-Highway Equipment; Low-Bed Machinery Trailer Axles; Heavy-Duty Vacuum and Air Brakes.

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